Reimagining Fond du Lac Avenue: Best Public Transit Options & Street Design

Prepared for Carl Glassmeyer | 1000 Friends of Wisconsin

Khari Bell, Jake Boxrud, Tekla Kilpatrick, Cole Martin, Gabriel Yeager

Fall 2023

December 12, 2023

To: Carl Glassmeyer, Transportation Policy Analyst, 1000 Friends of Wisconsin
Phone: 816-668-1052
E-mail: carl@1kfriends.org
CC: Professor Robert Schneider, PhD, Associate Professor of Urban Planning and Department Co-Chair, UWM

RE: Best Public Transit Options & Street Design for West Fond du Lac Avenue

Dear Mr. Glassmeyer,

Thank you for the opportunity to explore the future of Fond du Lac Avenue with you, and how it serves the Milwaukee community, particularly for the residents who live adjacent to the commercial corridor and traverse it daily.

Fond du Lac Avenue consistently ranks among the most dangerous and deadliest streets in Milwaukee, including having five of the city's top crash intersections. This is in large respect due to the diagonal character of the street, creating several six-way intersections where three major streets converge. This has also created difficult crossing conditions for pedestrians, public transit riders, and bicyclists.

Throughout the engagement process, we have consistently heard from neighborhood stakeholders that the top priority remains ensuring the safety of vehicular and pedestrian traffic along the corridor. Through this lens, our intention is to propose both near-term and long-term visions for the future of Fund du Lac Avenue.

The purpose of this report is to explore four alternatives for 1000 Friends of Wisconsin to consider when advocating for improvements and public investment in this important northwest corridor in our region. The alternatives explored include dedicated streetcar lanes, dedicated bus rapid transit – or BRT – lanes, adding bus islands to the existing street configuration, and adding traffic calming and pedestrian safety elements through tactical urbanism, including bump outs and protected bike lanes.

Again, thank you for the opportunity to collaborate with you on reimagining Fond du Lac Avenue. Please feel free to reach out to us with further questions as you continue your advocacy efforts.

Sincerely,

Khari Bell, Jake Boxrud, Tekla Kilpatrick, Cole Martin, and Gabriel Yeager
University of Wisconsin – Milwaukee, Master of Urban Planning Students

Executive Summary

Problem

"I avoid Fond du Lac at all costs, for safety concerns." – Maricha Harris, Executive Director, Dominican Center

Fond du Lac Avenue, or Wisconsin State Highway 145, is a major corridor that runs diagonally, northwest from Milwaukee's central business district. The commercial corridor services 19,500 to 27,700 vehicles daily, in addition to MCTS bus routes, the BlueLine and Route 81. Because of its diagonal character, Fond du Lac Avenue features several six-way intersections where three major streets converge. This has created dangerous, and even deadly conditions. The street features five of the city's top crash intersections and is responsible for 27 fatalities between 2017 and 2022. These conditions have created a negative effect on adjacent neighborhoods, which have experienced a 20% population decline since 2000, according to the City of Milwaukee's Fond du Lac and North neighborhood plans. Thus, through public safety and equity lens, the reimagined Fond du Lac Avenue seeks to stabilize the neighborhood as a vibrant commercial corridor – one that promotes walkability and street-level businesses and activity.

Criteria

- Effectiveness: The preferred alternative must improve transit times in the corridor by at least 10%.
- Equity: The preferred alternative must result in no more than two traffic fatalities on Fond du Lac Avenue from 2037 – 2041.
- Cost: The preferred alternative must produce a positive Net Present Value (NPV).
- Political Feasibility: The preferred alternative must generate support from residents as well as the 30th Street Industrial Corridor (No.37) and North Avenue Marketplace (No.32) business improvement districts (BIDs).

Alternatives

1. Streetcar: Explore extending The Hop streetcar with a designated streetcar lane in both directions on Fond du Lac Avenue.
2. BRT Light and Protected Bike Lanes: Explore a similar system to Chicago's Milwaukee Avenue Pulse BRT Line, in addition to adding a protected bike lane.
3. BRT with Transit Oriented Development (TOD): Explore a BRT system with protected bus lanes and bus loading zone bump-outs. Transit Oriented Development should also be encouraged along the corridor.
4. Tactical improvements: A reconfigured road diet and bump-outs at intersections will calm vehicular traffic along the corridor, as well as improve the pedestrian experience.

Recommendation

Ultimately, we recommend implementing tactical urbanism projects along Fond du Lac Avenue for the most immediate impact on the safety of those who use the corridor daily. Safety emerged as a top priority from stakeholders, and continuing work already underway by DPW will ensure a safer corridor in the immediate future, while bold visions are considered for long-term improvements and neighborhood growth.

Problem Statement

Known as a dangerous "speedway," Fond du Lac Avenue, or Wisconsin State Highway 145, is a major diagonal corridor that runs northwest from Milwaukee's central business district through the Amani, Metcalfe Park, Lindsay Heights, and Midtown neighborhoods. Between 19,500 and 27,700 vehicles traverse the corridor daily, along with MCTS bus routes the Blueline and Route 81.[1] Because of the corridor's diagonality, Fond du Lac Avenue features several three-way intersections, making it the deadliest street in the city, with 27 fatalities between 2017 and 2022.[2]

Furthermore, the 2022 Milwaukee Police Department Community Report indicates five intersections along Fond du Lac Avenue among the top crash intersections in the city (See more in Appendix A).[3] To illustrate the corridor's cost burden on the city, the intersection of Fond du Lac Avenue and West Locust Street has a total crash cost of $43,875,000, when pedestrian crash costs and vehicular crash costs are combined, making it one of the costliest intersections in the city.[4] Despite it being an unsafe street, only a 0.61-mile section is scheduled for replacement, between 13th Street and 20th Street by 2026.[5]

The City of Milwaukee's Department of City Development released an updated neighborhood plan for Fond du Lac and North, in November 2021. The plan indicates a 20% decline in population since 2000, from 28,593 residents in 2000 to 23,927 residents in 2024, compared to the city's modest population decline of 4.5% between 2000 and 2021.[6] According to the plan, the population loss in neighborhoods adjacent to Fond du Lac Avenue "presents unique challenges, but also opportunities for an area with many vacant lots, houses, and commercial buildings."[7] In addition, large swaths of land adjacent to the corridor were cleared for a proposed highway that was never built.[8]

Thus, with a public safety and equity lens, the reimagined Fond du Lac Avenue will serve as a catalyst for neighborhood investment, ensure a safer driving and walking experience, and restore the built environment into a lively, vibrant commercial corridor.

[1] Urban Milwaukee- Can City Make Fond du Lac Avenue Safer
[2] TMJ4- The Two deadliest streets in Milwaukee County intersect on Milwaukee's north side
[3] MPD- 2022 Milwaukee Police Department Community Report: Strategies, Initiatives and Partnerships
[4] City of Milwaukee DPW– Crash Analysis Report
[5] Urban Milwaukee- Can City Make Fond du Lac Avenue Safer
[6] Google- Milwaukee Population
[7] City of Milwaukee DCD- Fond du Lac & North
[8] Urban Milwaukee- Can City Make Fond du Lac Avenue Safer

Criteria

Effectiveness: The preferred alternative must improve transit times in the corridor by at least 10%.

Rationale: While transit passengers value a wide variety of features associated with public transportation, surveys continue to stress that passengers' highest priorities are frequent, fast and reliable service.[9] To create a better public transit environment for MCTS Blue Line passengers (among whom 83% are African American),[10] as well as the 68% of MCTS minority-employees who must contend with high levels of congestion on Fond du Lac Avenue,[11] the preferred alternative must improve transit times by at least 10%. Achieving this mark would not only serve current passengers' desires, but also reduce difficult working conditions related to traffic congestion and bus driver well-being.[12]

Equity: The preferred alternative must result in no more than two traffic fatalities on Fond du Lac Avenue from 2037-2041.

Rationale: Traffic-related fatalities reached 18 for the 5-year period of 2018-2022 along the five-mile corridor between Walnut and Hampton.[13] City of Milwaukee has adopted a Vision Zero initiative which aims to achieve zero traffic fatalities throughout the city by 2037.[14] This initiative is of particular importance for Milwaukee's BIPOC community, as national[15] and local trends[16] indicate that minority communities are disproportionately affected by traffic crashes and fatalities. While it is difficult to guarantee an absolute elimination of traffic fatalities, for the city to better meet its 2037 goal, the preferred alternative must ensure a safer environment for all residents traversing the Fond du Lac Avenue corridor.

Cost: The preferred alternative must produce a positive Net Present Value (NPV).

Rationale: Ensuring the preferred alternative produces economic benefits for the community is an important consideration given finite financial resources. WisDOT's Safety Certification Process, a process that seeks to evaluate the safety performance of roadway improvement projects, states that the department finds projects with benefit-cost ratios over 1 to be economically beneficial (more beneficial than costly) for a community.[17] NPV, a measure that also seeks to measure economic performance of a project while accounting for the time value of money, produces an economically beneficial project when it is positive (I.E. produces more benefits than costs).

---

[9] Transit Center- Who's on Board 2016- What Today's Riders Teach Us About Transit That Works
[10] MCTS- Blue Line Remix
[11] MCTS- 2019 Annual Report
[12] American Psychological Association- Traffic Congestion, Perceived Control, and Psychophysiological Stress Among Urban Bus Drivers (1991)
[13] WisDOT- Community Maps - Crash (wisc.edu)
[14] City of Milwaukee Department of Administration- Vision Zero
[15] CDC- Morbidity and Mortality Weekly Report (2022)
[16] Wisconsin Bike Fed- Learning From Milwaukee's Record-High Pedestrian Fatalities
[17] WisDOT- Safety Certification Process General Overview

Political Feasibility: The preferred alternative must generate support from residents as well as the 30th Street Industrial Corridor (No.37) and North Avenue Marketplace (No.32) business improvement districts (BIDs).

Rationale: A key objective of reimagining Fond du Lac Avenue is creating a corridor that is safe and vibrant for residents and businesses. Historical and current WisDOT projects, such as the proposal to expand I-94 to 8 lanes, have received criticism for their lack of investment in local transportation needs.[18] To better ensure that project benefits are felt locally, the preferred alternative must secure support from residents and corridor-adjacent BIDs.

[18] BizTimes- WisDot to Pursue Eight Lane Expansion Along I94 East-West Corridor

Alternatives

Alternative 1: Dedicated Streetcar Lane

This alternative proposes the construction of a streetcar line on Fond du Lac Avenue from Walnut Street to Hampton Avenue. The streetcar line will have its own dedicated lane at street level to further prevent accidents and deaths.[19] In Toronto, a similar streetcar system saw a 48% reduction in deaths after a designated lane was constructed.[20] The sense of a protected barrier between vehicular traffic and the streetcar may further decrease potential accidents. Streetcar stops will be boarded from far-side stops, to promote pedestrian safety and driver visibility.[21] This street layout can be seen in Appendix B – Dedicated Streetcar Lane.

The streetcar will serve as a catalytic investment in the northwest quadrant of the city, following the success of The Hop streetcar and is expected to draw economic growth.[22] This proposal will be planned with the possibility of future connections to the proposed Bronzeville to Walker's Point Hop expansion.[23] (See Appendix C)

Future connections will create a path for visitors to park near destinations and provide a route to downtown without the hassle of vehicular traffic. A new transit-oriented development on the streetcar system's furthest northwest point would help to increase ridership. This development could also add jobs and housing along Fond du Lac Avenue, and further strengthen its connection with downtown.

This alternative found existing case studies and estimated the average cost per mile of a streetcar (See Appendix D). The savings from accidents prevented were calculated by the number of deaths that have occurred on Fond Du Lac Avenue (See Appendix E). Operation costs and economic investment estimates were taken from the Hop. (See Appendix F). This alternative would cost $253,125,000. and have a net present value of -$65,690,25 (See Appendix G).

---

[19] Federal Transit Administration - Stops, Spacing, Location, and Design (2015)

[20] The Hospital for Sick Children and the University of Toronto- Exploring the impact of a dedicated streetcar right-of-way on pedestrian motor vehicle collisions: a quasi-experimental design (2014)

[21] Texas Transportation Institute- Guidelines for Planning, Designing, and Operating Bus Related Street Improvements (1990)

[22] Milwaukee Journal Sentinel- Property Values increase almost 28% along Milwaukee Streetcar Route, Mayor Barrett Says

[23] Urban Milwaukee- Committee backs 4 Streetcar Expansions (2023)

Alternative 2: Bus Rapid Transit (BRT) Light with Protected Bike Lane

The alternative proposes maintaining Fond du Lac Avenue's current four-lane configuration (with two 12' lanes in each direction), a 10' flex zone that includes island bus stops (with adjacent in-lane bus stops), parking spaces and loading/unloading zones on each side, and installation of 6' protected bike lanes between the flex zone and sidewalk. The alternative retains at least five feet for median space outside of intersection areas (Appendix B, Dedicated Bus Rapid Transit (BRT) Lane).

Along the narrower segment between North Avenue and Burleigh Street, the alternative proposes narrowing the existing four-lane configuration to two 12' lanes, continuing the 10' flex zone and new installation of 6' protected bike lanes. In this section, the alternative proposes maintaining existing bus station locations that necessitate a sharing of bike lane space. Currently, the MCTS Blue Line's scheduled time to traverse the corridor is 20 minutes.[24] While the alternative proposes buses continuing to operate in mixed-traffic lanes, the inclusion of near-level boarding and in-lane stops can save an estimated 5-10 seconds per bus stoppage. [25] [26] While the number of bus stoppages on each route-trip varies, busier times (rush hour) tend to have more stoppages thus enhancing time savings during the busiest hours. Additionally, the alternative proposes increasing stop spacing to ~0.5 mile and installing a transit signal priority (TSP) network to further boost speed and reliability of the Blue Line. Pace, the operator of the Milwaukee Avenue Pulse (BRT) Line in the City of Chicago and Village of Niles, has previously estimated that longer stop spacing and a TSP system can decrease transit times by ~5%.[27]

The installation of protected bike lanes would also have positive effects on the neighborhoods surrounding Fond du Lac Avenue. NACTO research has found that the presence of protected bike lanes often increases cycling usage rates by at least 20% (and often more).[28] Public fears that bike lane installations will lead to displacement are still prevalent among many minority residents today.[29] Given that the Fond du Lac Avenue corridor residents include a majority of Black and minority residents,[30] it is also important to note that additional research has found that there are few statistically significant associations between improved biking facilities and risks of resident displacement.[31]

---

[24] MCTS Route Timetables- Ride MCTS | BlueLine: Fond du Lac - National
[25] NACTO- Side Boarding Island Stop | National Association of City Transportation Officials (nacto.org)
[26] NACTO- Platform Height | National Association of City Transportation Officials (nacto.org)
[27] Pace- Milwaukee Avenue Corridor Arterial Rapid Transit: 2014 Project Definition Report (p.91)
[28] NACTO- High-Quality Bike Facilities Increase Ridership and Make Biking Safer | National Association of City Transportation Officials (nacto.org)
[29] Washington Post- Why are bike lanes such heated symbols of gentrification? - The Washington Post 2015
[30] U.S. Census Bureau 2021 ACS 5-year estimates- S0601: SELECTED CHARACTERISTICS OF ... - Census Bureau Table
[31] ScienceDirect- Bicycling facility inequalities and the causality dilemma with socioeconomic/sociodemographic change - ScienceDirect (2021)

Alternative 3: Bus Rapid Transit (BRT) with Transit-Oriented Development (TOD)

This alternative proposes the strategic revitalization of West Fond du Lac Avenue through the introduction of a Bus Rapid Transit system integrated with Transit-Oriented Development principles. Drawing inspiration from the Cleveland Healthline, this approach addresses the complex challenges faced by the corridor, presenting a comprehensive solution for West Fond du Lac Avenue.

The Cleveland HealthLine BRT project serves as a model for West Fond du Lac Avenue, with similar corridor lengths, diagonal intersections, and a declining population. Despite Cleveland's demographic shifts, HealthLine demonstrated the effectiveness of a well-executed BRT system. The alignment between Euclid Avenue and Fond du Lac Avenue, spotlighting similarities and showcasing HealthLine's accomplishments, illustrates the potential success of a BRT implementation for Fond du Lac Avenue (See Appendix H). Upgrading amenities based on these lessons aims to create a dynamic and economically thriving corridor.

Detailing the pivotal role of signal prioritization in streamlining traffic, reducing delays, and augmenting BRT efficiency, incorporating features like Transit Signal Priority, Intersection Geometry Adjustments, Queue Jump Lanes, and BRT Vehicle Preemption stands central to this alternative's strategy (See Appendix I). Significant enhancements, such as advanced bus shelters, real-time information integration, community engagement, and an optimized BRT route design, emphasize accessibility, modernization, and eco-conscious considerations for a comprehensive upgrade (See Appendix J). Integrating TOD principles, green streetscape design, and Transportation Demand Management (TDM) strategies shape a secure, sustainable, and vibrant West Fond du Lac Avenue. This entails mixed-use zoning, green infrastructure, and TDM initiatives promoting alternative transportation modes (See Appendix K). A Net Present Value analysis was conducted, utilizing the Cleveland HealthLine as a benchmark, estimated construction costs, operational expenses, time savings, and economic benefits, resulting in a positive value (See Appendix L and M).

This alternative envisions West Fond du Lac Avenue as a secure, sustainable, and economically thriving urban hub. By tactically implementing a BRT system, refining bus infrastructure, embracing TOD principles, and integrating green design and TDM strategies, this alternative aspires to nurture equity, environmental sustainability, and community prosperity. The positive net present value underscores not just the financial viability but also the transformative potential awaiting the West Fond du Lac Avenue corridor, setting the stage for progressive urban development.

Alternative 4: Tactical Improvements

This alternative includes traffic calming, transit enhancements, and investments in pedestrian spaces to improve safety and transportation on Fond du Lac Avenue.

Dedicated Bus Lane: A lane of traffic will be dedicated to buses and right turns only between North Avenue and Burleigh Street in both directions. Buses will share a lane with vehicles at the Burleigh Street business node and through the Center Street intersection. The bus-lane eliminates parking in front of businesses between Burleigh Street and Roosevelt Drive. However, neighborhood streets such as N 21st Street allow for street parking on both sides of the street for neighboring businesses.

Restricted Access: Right turns will be allowed in the bus lane at N 20th Street, N 27th Street, Locust Street, and North 34th Street. but will not be allowed at intersection that directly follows each of these intersections. This will create a traffic free bus lane for a far-side bus stop after each major intersection. Additionally, vehicles on N 27th Street will no longer be able to turn left onto Fond du Lac Avenue and vehicles headed westbound on Center Street will not have access to turn left or right onto Fond Du Lac Avenue. Curb extensions will be added to the northeast corner of Center Street and Fond du Lac Avenue into the Center Street right-of-way to prevent right turns and encourage pedestrian activity. A curb extension will be added to the corner of 27th Street and Fond Du Lac Avenue. These access restrictions will encourage steady flows of traffic through the intersection and prevent traffic delays in the middle of the intersection.

Pedestrian Amenities: As Fond du Lac Avenue crosses Burleigh St., vehicles on N 35th St. will be restricted from turning northbound onto Fond du Lac Avenue. Vehicles headed northbound on N 35th street will no longer be able to turn right onto Fond Du Lac Avenue but will continue to be able to turn right onto Burleigh Street. A curb extension will replace the right slip lane. North of Burleigh Street, a curb extension will replace existing street parking in both directions. The new sidewalk space will encourage pedestrian generated economic activity in this business node. Extra sidewalk space will be dedicated for public art while simultaneously being used to prevent illegal right turns. A dedicated bus lane will resume after the far-side bus stop until it is replaced by residential street parking just north of W Roosevelt Drive. Bike lanes will remain north of Capitol Dr. (See Appendix B, Intersections, Bump-outs, and Far side Bus Stop)

Other Considerations: The portion of the road north of Capitol Drive remains unaltered, preserving its lifespan. Street parking south of Roosevelt Drive is rare and is better utilized for pedestrian and transit purposes. Businesses north of Burleigh Street will be most impacted by this change, as those parking spaces are often used. However, customers will continue to have access to side streets and parking lots. Bus lanes may lead to traffic delays Fond du Lac Ave. between North Avenue and Burleigh Street. This stretch experiences decreased daily traffic counts compared with other sections, due to the reroute of the designated truck route to N 35th Street. Restricted access onto Fond Du Lac Ave. from intersections at Center St. and Burleigh Street will help reduce traffic counts headed southbound on Fond Du Lac Avenue along this stretch. (See Appendix B, Intersection Bump-outs and Far-Side Bus Stop)

Evaluation

Alternative 1: Dedicated Streetcar Lane

Effectiveness: *Fail.* Streetcars have twice as much length and capacity as a bus.[32] Despite these capabilities there is no study that suggests that streetcars increase ridership. Streetcar speeds are half as fast as buses.[33] Therefore there is no benefit to travel time. Furthermore, within this alternative, travel time can be expected to decrease with a loss of a lane of car traffic.

Equity: *Fail.* Streetcars alone do not improve safety beyond that of a bus and will not prevent traffic fatalities.[34] Although a designated lane in streetcar design has been shown to effective in creating a 48% reduction of collisions[35]. This is leads us to expect a death rate of 5 persons in four years, which exceeds the criteria. (See Appendix E)

Cost: *Fail.* At a net present value of 65,690,255.78 this alternative is both expensive and ineffective.

Political Feasibility: *Fail.* Fond du Lac Ave needs a more immediate solution to increase safety than the time construction could take. Adding a designated lane does not immediately solve additional problems with car transit, such as reckless driving. The money for a streetcar could be seen as misplaced compared to local needs.

Alternative 2: Bus Rapid Transit (BRT) Light and Protected Bike Lanes

Effectiveness: *Pass.* By utilizing new near-level, in-lane bus boarding stations, transit signal priority (TSP) and more efficient stop spacing, MCTS can reduce the BlueLine's current transit times in the corridor by two minutes. Based on the current timetable, which establishes the current corridor transit time at 20 minutes, these improvements represent an estimated 10% increase in transit travel time.

Equity: *Fail.* While the alternative does improve cyclist safety with enhanced infrastructure (Appendix B, Dedicated BRT Lane), the alternative maintains the existing four-lane vehicle traffic configuration and does not directly implement pedestrian-focused safety enhancements. Because of this, vehicle and pedestrian crashes and deaths are not likely to be substantially reduced to the city's Vision Zero goals.

Cost: *Fail.* The total NPV of the alternative is negative $2.4 Million, thereby failing to produce more benefits for the community than benefits. The alternative utilizes enhanced, but relatively expensive, bus station designs, but does not realize the full benefit of these stations without the use of bus-only lanes. Furthermore, while some economic benefit can be generated from the new design (See Appendix N), the alternative does not maximize the ability to prevent traffic fatalities and injuries, a key benefit lost.

Political Feasibility: *Fail.* While local transit users will appreciate the enhanced stations and transit times, the largest concerns voiced by local residents have been related to traffic safety (particularly pedestrian safety) in the corridor. Due to the lack of pedestrian-focused safety improvements, the alternative is unlikely to garner significant local support.

---

[32] The Hop MKE- Frequently Asked Questions (2023)

[33] Florida State University- The Modern Streetcar in the U.S. (2013)

[34] Sage Journals- Longitudinal Analysis of Light Rail and Streetcar Safety in the United States (2020)

[35] ScienceDirect– Exploring the impact of a dedicated streetcar right-of-way on pedestrian motor vehicle collisions: a quasi experimental design (2014)

Alternative 3: Bus Rapid Transit (BRT) with and Transit Oriented Development (TOD)

Effectiveness: *Pass.* The current travel time of 53 minutes on the BlueLine would need to decrease to 47 minutes for the alternative to be effective (by 10%). The proposed BRT system is projected to reduce travel time to 40 minutes, surpassing the requirement with a 25% decrease (See Appendix J).

Equity: *Fail.* The current timeline for the BRT implementation extends beyond the specified completion date of 2037, with projected completion by 2050, as stated by the MCTS Planners.[36]

Cost: *Pass.* The alternative has a positive NPV of $19.5 Million (See Appendix M).

Political Feasibility: *Fail.* BIDs are likely to support the amount of economic improvement the project would bring, but residents would not, as it would not affect them until 2050, and safety improvements need to be done now.

Alternative 4: Tactical Improvements

Effectiveness: *Pass.* Currently the Blue Line travels takes 13 minutes to travel from Sherman Blvd to Walnut Street during peak hours. With a dedicated bus lane, we expect bus transit times to shorten to times comparable to non-peak hours, or 11 minutes. This will save 2-minutes of travel time for transit riders in the corridor, or 10%.[37]

Equity: *Pass.* Pedestrian improvements improve pedestrian and traffic fatalities. Comparing with similar studies, we expect traffic fatalities to decrease by 40 % within the first year and each year for the next 5 years. As traffic patterns change and traffic counts decrease, we expect traffic fatalities to reach approximately 1.5 in a 5-year time frame. [38]

Cost: *Pass.* The approximate cost for this alternative is $1.4 million. The expected net present value is $87 million. (See Appendix R and Appendix P).

Political Feasibility: *Fail.* Increased pedestrian improvements including additional pedestrian right of ways near businesses neighborhood beautification will be a welcomed investment in the neighborhood by both residents and businesses.

[36] MCTS Communication- UWM PPA Presentation (2023)

[37] MCTS- Blueline: Fond du Lac - Mill

[38] Health Resources in Action- Seattle, Washington Multi-Faceted Approach to Speed Reduction (2013)

Elevation Matrix

	Effectiveness	Equity	Cost	Political Feasibility
	Improve transit times in the corridor by at least 10%	*Result in no more than two traffic fatalities on Fond du Lac Avenue from 2037- 2041*	*Produce a positive Net Present Value (NPV)*	*Generate support from residents as well as the 30th Stret Industrial Corridor and North Avenue Marketplace BIDs*
Alternative 1	**FAIL**	**FAIL**	**FAIL**	**FAIL**
Dedicated Streetcar Lane	Does not improve travel times	4.68 deaths in 5 years	NPV is -$65,690,255.78	Would not address residents' current problems
Alternative 2	**PASS**	**FAIL**	**FAIL**	**FAIL**
Bus Rapid Transit (BRT) Light and Protected Bike Lane	Combination of in-lane stops, and TSP can improve transit times by 10%	Lack of pedestrian safety enhancements will not sufficiently reduce traffic fatalities	NPV is negative $2.4 Million, producing more costs than benefits	Large-scale street re-designs that don't directly address pedestrian safety are not likely to be supported by residents
Alternative 3	**PASS**	**FAIL**	**PASS**	**FAIL**
BRT with Transit Oriented Development (TOD)	Transit times would improve by 25%	BRT would not be completed until 2050.	NPV is $19.5 Million, producing economic benefits for the community	Would not be supported by residents
Alternative 4	**PASS**	**PASS**	**PASS**	**PASS**
Tactical Improvements	Transit times would improve by 10%	Traffic fatalities could be reduced by 30% in the first year	NPV is $87 Million dollars, significantly reducing economic losses from traffic crashes	Pedestrian improvements and beautification supported by businesses and residents

Recommendation

After evaluating all four alternatives, we chose Alternative 4, Tactical improvements, as our preferred alternative. This alternative improved transit times, decreased traffic fatalities, produced a positive net present value, and produced support from both residents and businesses in the neighborhood Business improvement District. We believe this alternative delivers the most significant contributions to safety while also encouraging supporting a positive transit experience for transit riders. In comparison to other alternatives, tactical improvements showed strength in its ability to provide much needed investment, quickly.

This alternative uses multiple traffic calming measures to ensure traffic safety. The use of bump outs and restricted vehicular access onto roads will increase pedestrian safety, discourage reckless driving, and steady the traffic flow throughout the corridor. The use of bump-outs provides an opportunity to activate these intersections as safe and beautiful gathering spaces that reflect the neighborhood communities. Investment in these urban design improvements is key to gaining local support for the project. Additionally, dedicated bus lanes in the narrowest sections of the corridor are essential to ensure reliable service for transit riders in spite of any traffic delays.

While this alternative is cost-efficient, with an estimated cost of $1-3 million dollars (see Appendix Q), cost can be a barrier to construction. The City of Milwaukee and WisDOT should determine how to share the costs, if necessary. Local residents and BIDs will have the opportunity to apply for a Reckless Driving Mini-Grant to fund part of the project and public space activation in target intersections[39]. This project preferred implementation timeline is 5 years but can be completed over time as funds become available.

[39] City of Milwaukee DPW-Reckless driving mini-grants

Monitoring

Monitoring the Tactical Improvements involves assessing its impact on Fond du Lac Avenue. Key considerations include regular evaluations of traffic flow. MCTS will closely monitor bus lane performance, including travel time and schedule adherence. Key intersections like N 20th Street, N 27th Street, Locust Street, North 34th Street, and Center Street require special attention in the first year of implementation. While signal prioritization is currently not an option in Wisconsin, MCTS and SEWRPC reserve the right to recommend the technology and other modifications to maximize transit efficiency and traffic safety as they deem necessary.

In the first five years of implementation, a community monitoring committee made up of residents and businesses will assess pedestrian safety and activity. They will observe pedestrian activity in areas where street parking is replaced by pedestrian rights-of-way and will assess impacts on safety and economic activity. The elimination of parking spaces will be monitored for changes in customer access, side street parking availability, and overall economic implications for businesses. Ensuring compliance with restricted access and assessing deterrent measures, such as curb extensions, are crucial for preventing illegal turns onto Fond du Lac Avenue. The community monitoring committee and local BIDS will monitor the incorporation of public art displays into pedestrian spaces and will gauge their impact on the community and aesthetics. Tracking bike lane usage and effectiveness north of Capitol Dr. will ensure safer cycling conditions and increased alternative transportation. Establishing feedback mechanisms for businesses, residents, and commuters will provide valuable insights, aiding in identifying unforeseen issues and areas for improvement. Safety metrics, including accident rates, will be closely monitored to prevent changes compromising overall road safety. This systematic approach allows planners to gain insights and adjust for the Tactical Improvements Alternative's effectiveness over the five-year implementation period.

Appendix

Appendix A: Top Crash Intersections on Fond du Lac Avenue

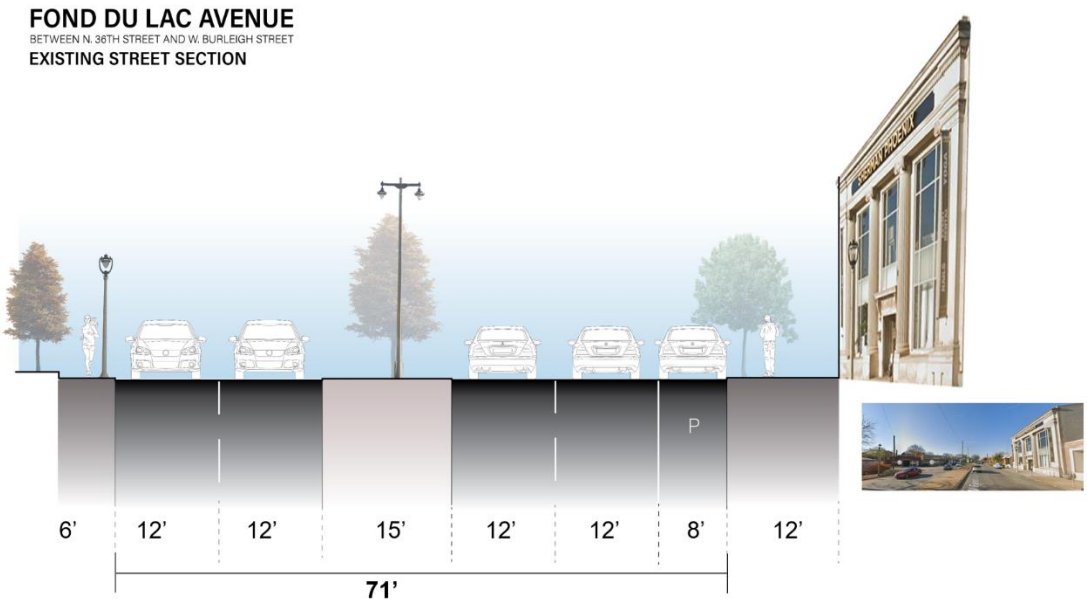
Looking at the past one-year period, there were 16,349 crashes from May 31, 2021-May 31, 2022. Of those crashes, there were 67 fatal victims and 6,509 hit and runs. The top crash intersections are included below.

Top Crash Intersections on Fond du Lac Avenue Between May 2021 – May 2022			
Intersection	Total Number of Crashes	Hit & Run Crashes	Fatalities
W. Capitol Dr. & W. Fond du Lac Ave.	43	12	0
N. 27th St. & W. Fond du Lac Ave.	40	16	0
W. Center St. & W. Fond du Lac Ave.	38	14	0
W. Burleigh St. & W. Fond du Lac Ave.	37	16	0
N. 35th St. & W. Fond du Lac Ave.	34	12	0

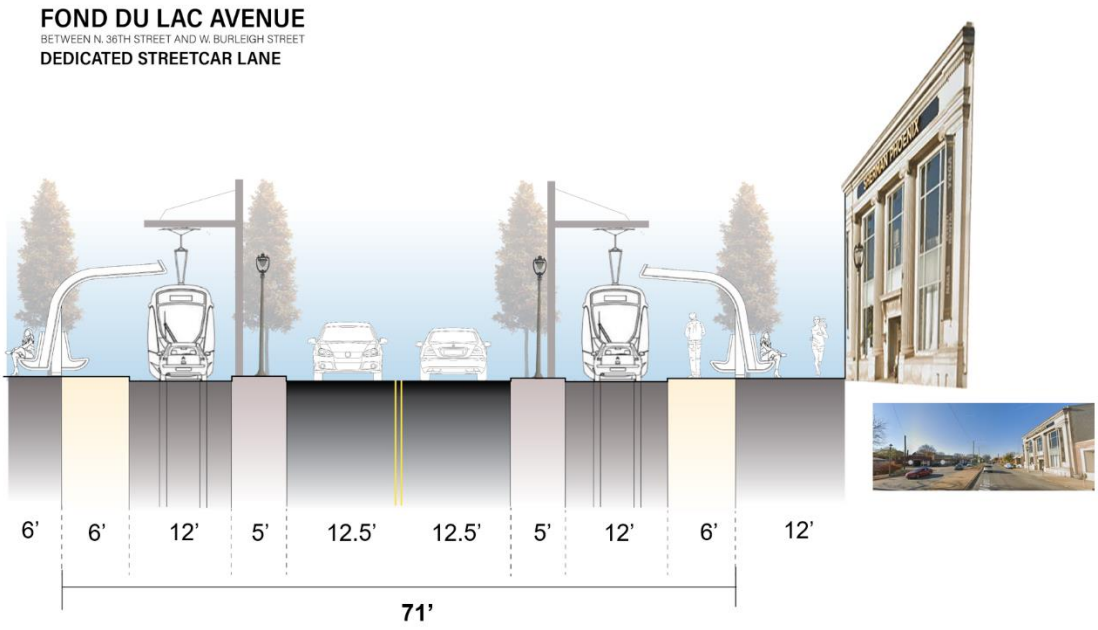
Source: 2022 Milwaukee Police Department Community Report: Strategies, Initiatives and Partnerships," June 2022, https://mkepdpio.org/wp-content/uploads/2022/06/2022-milwaukee-police-department-community-report.pdf.

Appendix B: Street Sections

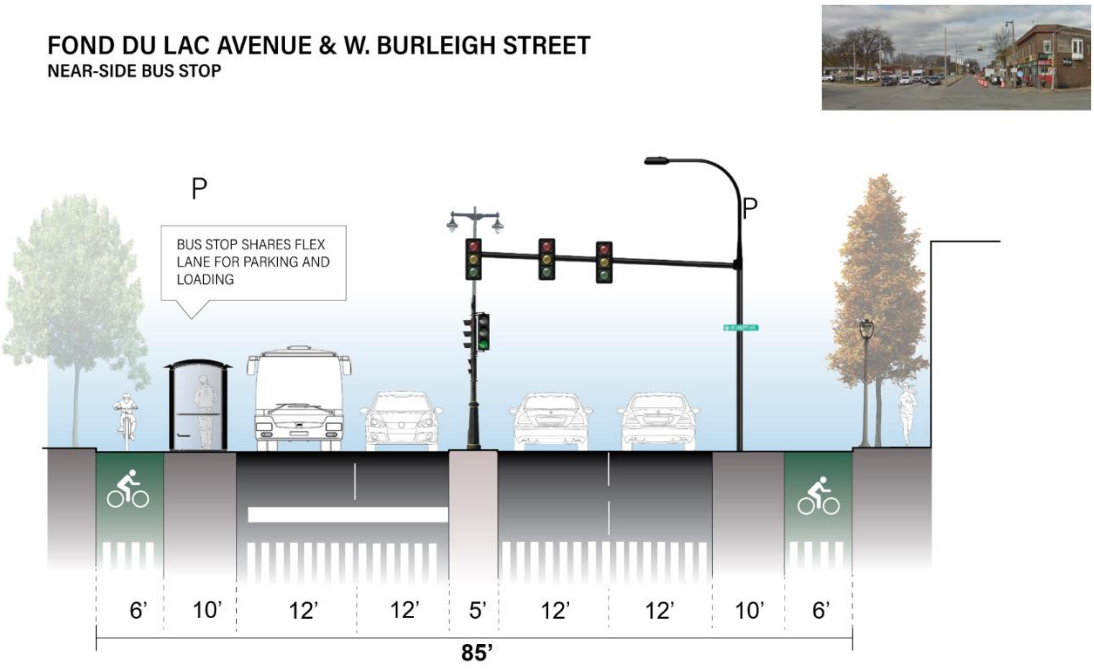
Existing Street Section



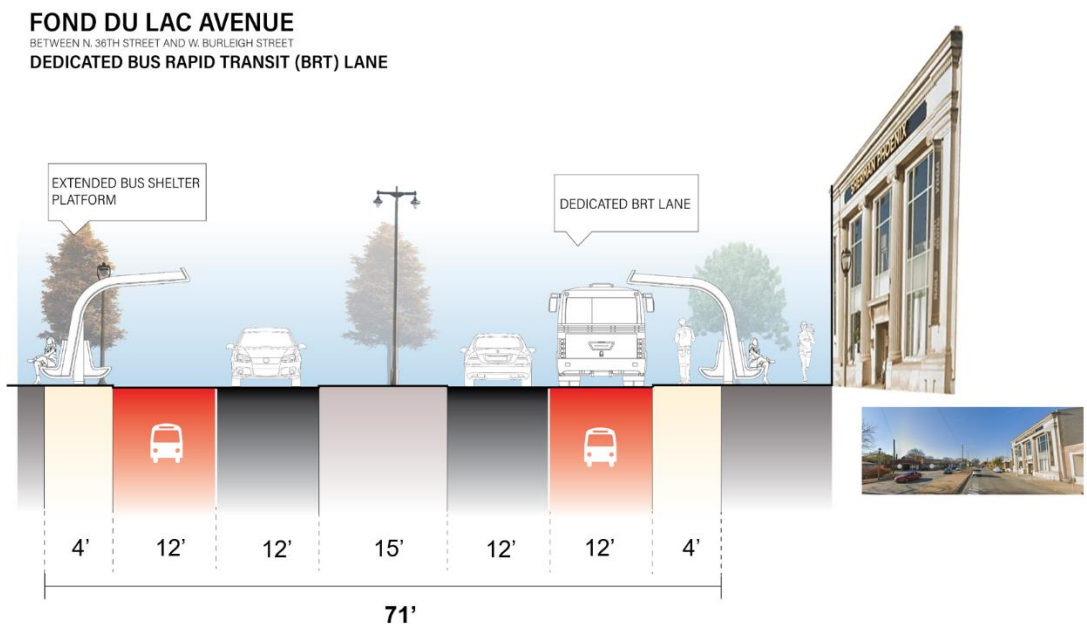
Alternative 1: Dedicated Streetcar Lane



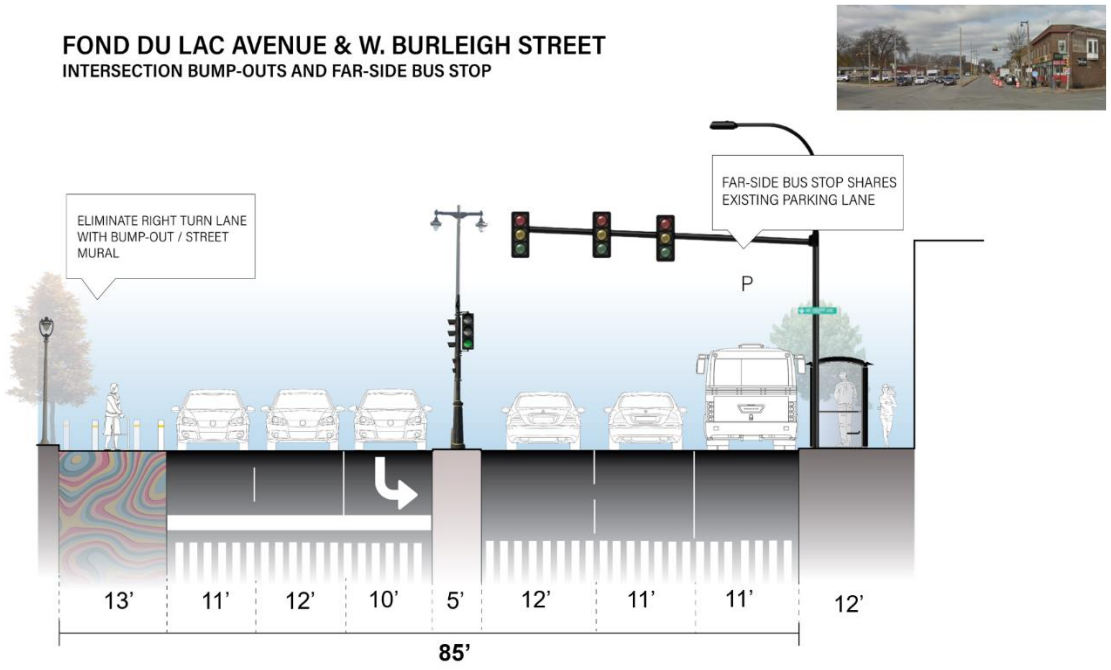
Alternative 2: BRT Light with Protected Bike Lanes



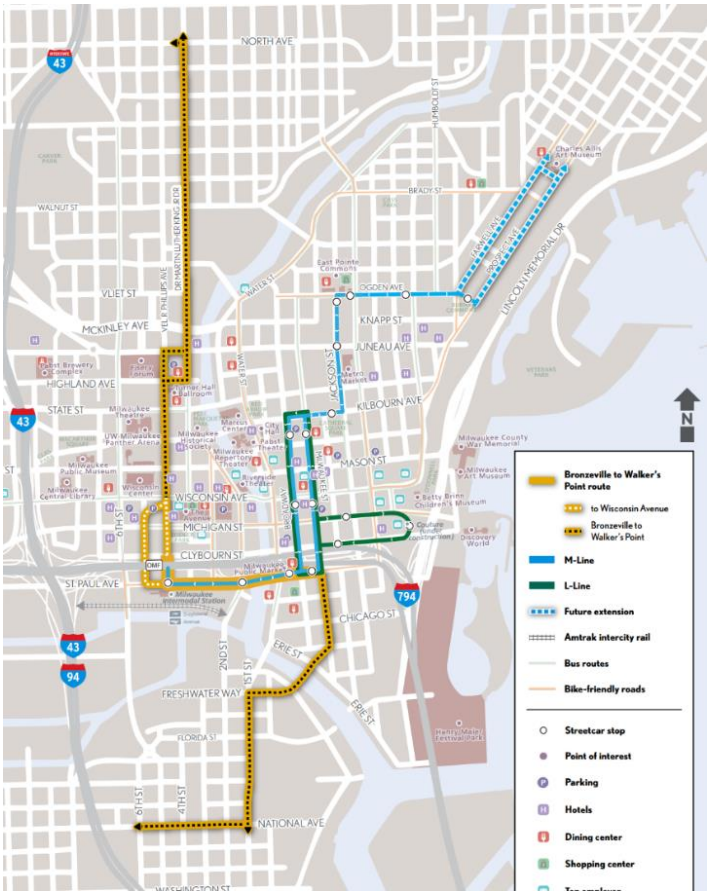
Alternative 3: Dedicated Bus Rapid Transit (BRT) Lane



Alternative 4: Tactical Improvements



Appendix C: Considerations for The Hop Streetcar Expansions



Appendix D: Estimating Average Cost Per Mile of Streetcar		
Line	Cost/Mileage=	Cost per Mile
The Hop (2018) [40]	98.9M/ 2.1	$47.09M per mile
Detroit Q Line (2017) [41]	187M/3.3	$56.%6M per mile
Seattle S. Lake Union (2007) [42] [43]	53.5M / 1.3	$41.15M per mile
Toronto Expansion (2006) [44]	135M / 2.5	$54M per mile
	Average Cost Per Mile	$49.725 per mile

[40] Railway Technology- The Hop Streetcar, Milwaukee, Wisconsin (2019)
[41] GMRENCEN- Everything you Need to Know About Detroit's QLine
[42] Planetizen- Has Seattle Found the Way Forward for Streetcars? (2015)
[43] U.S. Department of Transportation Federal Highway Administration- Project Profile: South Lake Union Streetcar
[44] StreetsblogUSA- What Toronto Learned By Giving Its Streetcar Its Own Lane (2019)

Appendix E: Streetcar Evaluation: Deaths Per Year		
Annual rate of death	Designated lane - death reduction	Total number of deaths per year
9	4	
=9 (9*0.48)	4.68	

Appendix F: Streetcar Cost-Benefit Analysis

Categories	Values
Construction Costs (Adjusted 1 year)	$248,625,000
Operation Costs (Adjusted 1 year)[45]	$10,714,286
Daily Customers	1287
Daily Savings Per Person	$0.38
Total Daily Minutes	480,000
Total Annual Minutes	66,670,058
Time Savings Per Day	$12,870
Economic Benefits Annually[46]	$183,675,000
Time Savings for 1 year	$(357,014)
Additional Benefit Per Mile	$(357,014)
Total Deaths between 2008 to 2018	9
Value of Statistical Life Per Person	$12,474,000
Total Saved for each Death Prevented	$58,378,320
Total Benefits	$234,857,109
Total Costs	$257,554,217
Net Benefit	$(26,928,952)
Cost Benefit Ratio	0.93

[45] Sage Journals- Longitudinal Analysis of Light Rail and Streetcar Safety in the United States (2020)

[46] Milwaukee Journal Sentinel- Property Values increase almost 28% along Milwaukee Streetcar Route, Mayor Barrett Says (2018)

Appendix G: Net Present Value of Streetcar

		Annual Benefits		
Year	Period	Public Transport. Ben.	Pedestrian Inj. Prev.	Total Benefits
2023	0			$0.00
2024	1	$12,500,000.00	$10,777,536.00	$23,277,536.00
2025	2	$12,500,000.00	$10,777,536.00	$23,277,536.00
2026	3	$12,500,000.00	$10,777,536.00	$23,277,536.00
2027	4	$12,500,000.00	$10,777,536.00	$23,277,536.00
2028	5	$12,500,000.00	$10,777,536.00	$23,277,536.00
2029	6	$12,500,000.00	$10,777,536.00	$23,277,536.00
2030	7	$12,500,000.00	$10,777,536.00	$23,277,536.00
2031	8	$12,500,000.00	$10,777,536.00	$23,277,536.00
2032	9	$12,500,000.00	$10,777,536.00	$23,277,536.00
2033	10	$12,500,000.00	$10,777,536.00	$23,277,536.00
2034	11	$12,500,000.00	$10,777,536.00	$23,277,536.00
2035	12	$12,500,000.00	$10,777,536.00	$23,277,536.00
2036	13	$12,500,000.00	$10,777,536.00	$23,277,536.00
2037	14	$12,500,000.00	$10,777,536.00	$23,277,536.00
2038	15	$12,500,000.00	$10,777,536.00	$23,277,536.00
2039	16	$12,500,000.00	$10,777,536.00	$23,277,536.00
2040	17	$12,500,000.00	$10,777,536.00	$23,277,536.00
2041	18	$12,500,000.00	$10,777,536.00	$23,277,536.00
2042	19	$12,500,000.00	$10,777,536.00	$23,277,536.00
2043	20	$12,500,000.00	$10,777,536.00	$23,277,536.00

Annual Costs				Discount rate	0.0700	
Construction	Marginal Oper. Cost	Time Added Costs	Total Costs	(Benefits - Costs)	Denominator	(Benefits - Costs)/Denominator
$250,000,000.00			$250,000,000.00	-$250,000,000.00	1.00	-$250,000,000.00
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.07	$16,259,379.44
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.14	$15,195,681.72
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.23	$14,201,571.70
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.31	$13,272,496.92
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.40	$12,404,202.73
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.50	$11,592,712.83
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.61	$10,834,311.05
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.72	$10,125,524.35
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.84	$9,463,106.87
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	1.97	$8,844,025.11
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.10	$8,265,444.03
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.25	$7,724,714.05
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.41	$7,219,358.92
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.58	$6,747,064.41
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.76	$6,305,667.67
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	2.95	$5,893,147.36
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	3.16	$5,507,614.35
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	3.38	$5,147,303.14
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	3.62	$4,810,563.68
	$5,700,000.00	$180,000.00	$5,880,000.00	$17,397,536.00	3.87	$4,495,853.90
					NPV =	-$65,690,255.78

Notes:
1. *Operating costs are estimated at $10.7 million per year, which represents an additional $5.7 million over current o*
2. *Public transportation benefits are based on APTA's 5:1 ratio of construction costs to economic benefits. In this alternative, a 1:1 ratio estimates a high level of economic benefit due to higher construction costs. To remain conservative in estimates, this lower ratio is used.*
ion notes for time added, construction costs and marginal operating costs are available in AP
4. *A social discount rate of 7% is used*
d on the negative NPV, the alternative should not be considered j
5. Injuries per five years are estimated to be reduced to 4.68 (down 48%) based on a study Richmond, Sarah. The Hosp
6. Construction Costs are calculated from the average costs by mile of 4 different streetcar lines. The average cost was rounded up to be used as the construction cost. (see table below)
7. Time added cost is due to the fact a Street car is twice as slow as a bus. Brown, Jeffrey. Florida State University. The Modern Streetcar in the U.S. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nctr.usf.edu/wp-content/uploads/2013/12/jpt16.4_Bro

Appendix H: Cleveland Healthline Bus Rapid Transit Precedent Study

The success of the Cleveland HealthLine BRT project provides insights for the proposed enhancements along West Fond du Lac Avenue. Operating along Euclid Avenue, the HealthLine stands as a testament to the resilience of TOD in regions experiencing population decline, a scenario like Milwaukee. Notably, the Euclid Corridor shares similarities with the Fond du Lac Corridor—they are comparable in length, with Fond du Lac spanning 5 miles and Euclid covering 7 miles. Both corridors feature diagonal intersections, connecting diverse neighborhoods, and serving as vital conduits linking the outskirts of the city to the downtown core.

Despite Cleveland's metro area losing 85,000 residents between 2000 and 2012, HealthLine defied conventional beliefs that TOD is only viable in growing economies[47]. HealthLine's achievement challenges preconceived notions that significant real estate development can only be stimulated by rail-based transit systems, proving that a well-executed BRT line can be equally transformative. The HealthLine was named the 'Best' Bus Rapid Transit in North America by the Institute for Transportation & Development Policy and was recognized for having the best return on investment for a transit project, regardless of mode, in the country[48] demonstrates the transformative potential of a well-executed BRT line. Operating 24/7 with a 10-minute frequency during peak travel periods, HealthLine replaced 108 bus stops with 36 strategically spaced stations, reducing travel time and providing a convenient and efficient transit experience. The financial impact of the HealthLine, with a total cost of $200 million delivering over $9.5 billion in economic development along the Euclid Corridor, serves as a powerful testament to the economic feasibility of BRT-based TOD initiatives[49]. This return on investment underscores the economic feasibility of BRT-based TOD initiatives and establishes a compelling case for the potential benefits awaiting the West Fond du Lac Avenue corridor.

Inspired by the success of the HealthLine, the proposed upgrades for West Fond du Lac Avenue include well-designed shelters, real-time arrival information displays, and various transit-oriented amenities. By drawing lessons from the Euclid Corridor's finance, urban development, and community engagement, these enhancements aim to guide West Fond du Lac Avenue towards establishing a transit system that efficiently meets transportation needs while catalyzing sustainable and inclusive urban development.

The parallels between the Euclid and Fond du Lac corridors, from their length and diagonal intersections to their role in connecting diverse communities, further strengthen the case for implementing BRT-based TOD initiatives along West Fond du Lac Avenue. Leveraging the achievements of HealthLine, Milwaukee can aspire to create a vibrant and economically thriving corridor that significantly contributes to the cultural and economic landscape of the corridor.

---

[47] UrbanSCALE.com- How Your City Can Succeed In Transit Oriented Development
[48] Case Western Reserve University- Public Transportation | Parking Services |
[49] RTA- RTA's HealthLine -- the world-class standard for BRT service | rideRTA.com

Appendix I: Signal Prioritization at Key Intersections on West Fond du Lac Avenue to Enhance Efficiency

Signal prioritization at intersections is a crucial element of the proposed BRT system along West Fond du Lac Avenue. This appendix provides an in-depth overview of the signal prioritization strategy designed to optimize traffic flow and ensure the timely and efficient movement of BRT vehicles through key intersections at Fond du Lac Ave and W Hampton Ave, Fond du Lac Ave and Capital Drive, Fond du Lac Ave and Center Street, and Fond du Lac Ave and Burleigh with the end point being at the roundabout at W Juneau Ave and W Winnebago Ave.

Signal Prioritization Features:

1. *Transit Signal Priority (TSP):*
- The TSP system will be implemented at the listed intersections along West Fond du Lac Avenue to give priority to BRT vehicles.
- TSP uses intelligent transportation systems to adjust traffic signal timings in real-time based on the location and schedule of approaching BRT buses.
2. *Intersection Geometry Adjustments:*
- Consideration will be given to the geometric layout of intersections to facilitate smooth BRT vehicle turns and minimize delays.
- Dedicated turning lanes for BRT vehicles and adjustments to signal phasing will be employed to optimize intersection efficiency.
3. *Queue Jump Lanes:*
- Queue jump lanes will be incorporated at selected intersections, allowing BRT vehicles to bypass traffic queues and access dedicated lanes ahead of general traffic.
- This design minimizes delays and ensures uninterrupted BRT service.
4. *Preemption for BRT Vehicles:*
- Emergency preemption features will be integrated into the signal prioritization system to allow BRT vehicles to expedite through intersections in emergency situations.
- This feature ensures the safety and efficiency of BRT operations, particularly during unforeseen events.

Benefits of Signal Prioritization:

1. *Reduced Travel Times:*
- Signal prioritization will significantly reduce travel times for BRT passengers, making public transit a more reliable option for commuters.
- The reduction in travel times contributes to the overall efficiency and appeal of the BRT system.
2. *Improved Schedule Adherence:*
- Ensuring that BRT vehicles adhere to their schedules enhances the reliability of the transit service.

- Passengers can rely on timely arrivals and departures, fostering increased confidence in public transit.

3. *Enhanced Overall Corridor Efficiency:*

- Signal prioritization not only benefits BRT vehicles but also improves overall traffic flow along West Fond du Lac Avenue.
- The optimized intersection management contributes to a more efficient and harmonious transportation network.

Signal prioritization at intersections is a key component of the proposed BRT system on West Fond du Lac Avenue. This innovative approach ensures the seamless integration of BRT vehicles into existing traffic patterns, enhancing efficiency, reducing travel times, and making public transit a more attractive and reliable option for the community.

Appendix J: Enhancement of Bus Infrastructure and BRT Route Design

The success of the proposed BRT system for West Fond du Lac Avenue relies heavily on the enhancement of bus infrastructure. Here are suggestions for enhancements to add:

1. *Bus Shelter Upgrade:*

- Prioritize comfort by providing seating and protection from the elements.
- Ensure accessibility features for individuals with mobility challenges.
- Consider integrating real-time arrival information displays within and around shelters for up-to-date, multilingual information.

2. *Real-Time Information Integration:*

- Explore integrating real-time information displays with mobile apps to provide on-the-go access for passengers.
- Multilingual options should be available for a diverse user base.

3. *Community Engagement:*

- Establish feedback mechanisms to involve the community in expressing preferences and concerns.
- Build a sense of ownership and pride in the upgraded infrastructure by actively engaging the community.

4. *BRT System Efficiency:*

- Maintain four continuously running bus lines to minimize passenger wait times and streamline the transit network. This number can also be modified to better serve the community.
- Conduct a careful evaluation of existing routes to eliminate redundancies and enhance overall transit effectiveness.
- Prioritize frequency and reliability to minimize wait times and ensure timely arrivals.

5. *Integration with Other Modes:*

- Ensure seamless integration with other transportation modes for convenient access to major destinations and transit hubs.

- Tailor bus lines to meet the unique needs of the diverse local population, aligning with a community-centric design.

6. *Accessibility Features:*

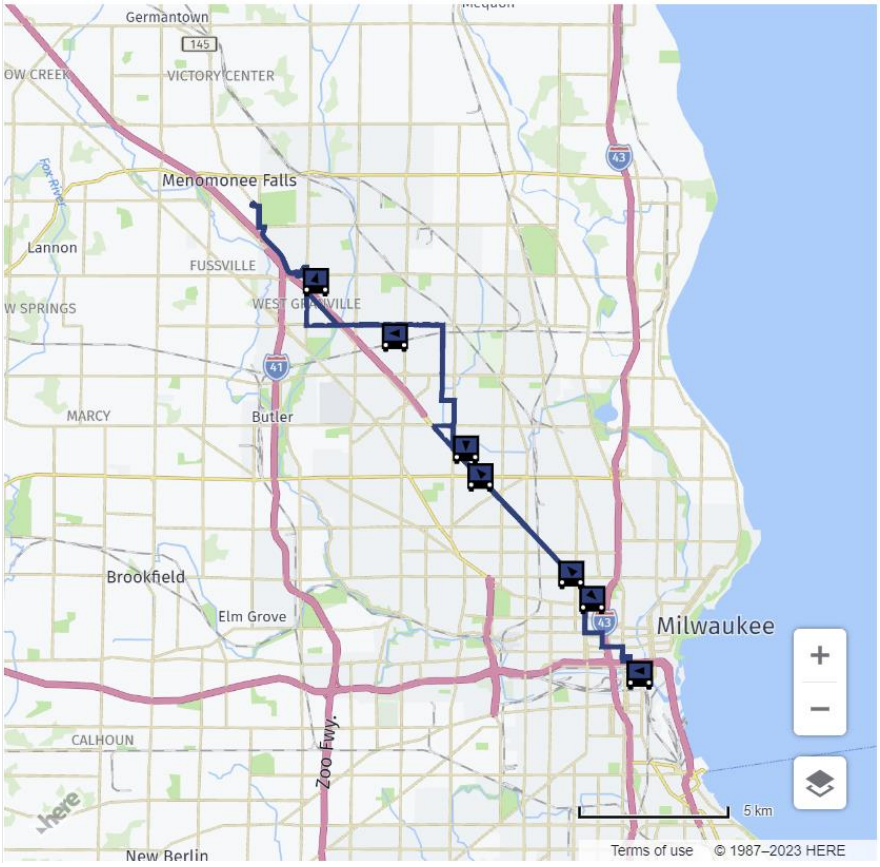
- Prioritize accessibility with features like ramps, shelters, seating, and real-time information displays at bus stops.
- Integrate technological solutions, such as mobile apps and digital displays, for route planning and real-time tracking.

7. *Environmental Considerations:*

- Explore eco-friendly bus options, green infrastructure, and energy-efficient practices to minimize environmental impact.
- Focus on modern, comfortable, and aesthetically pleasing bus design to combat the stigma associated with buses.

Comparative Analysis: BlueLine vs. HealthLine:

The current BlueLine provides service to the area, with an average travel time of approximately 5.89 minutes per stop. However, the proposed BRT aims to surpass this efficiency. A comparative analysis with Cleveland's HealthLine, running at 15 minutes or better frequency, indicates that the BRT can be a superior improvement.

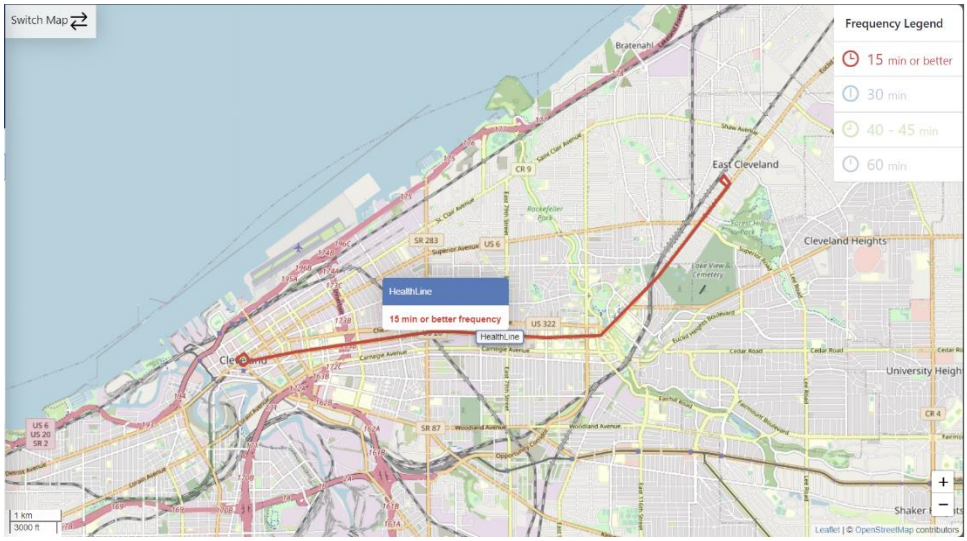


Map Provided by Milwaukee County Transit Systems[50]

1. Park Place and Liberty Stop Time difference between 7:19 am and 7:28 am: 9 minutes
2. 76th and Mill Time difference between 7:28 am and 7:37 am: 9 minutes
3. 60th and Villard Time difference between 7:37 am and 7:39 am: 2 minutes
4. Fond du Lac and Constance Time difference between 7:39 am and 7:47 am: 8 minutes
5. 60th and Hampton Time difference between 7:47 am and 7:50 am: 3 minutes
6. Fond du Lac and Sherman Time difference between 7:50 am and 7:56 am: 6 minutes
7. 35th and Burleigh Time difference between 7:56 am and 7:59 am: 3 minutes
8. North and Fond du Lac Time difference between 7:59 am and 8:07 am: 8 minutes
9. 17th and Walnut Time difference between 8:07 am and 8:12 am: 5 minutes

All these times are for 11/29/23

The current bus route that provides service to this area is the BlueLine. The average travel time going southbound for each stop is approximately 5.89 minutes. The completion of this route from Park Place to Walnut takes approximately 53 minutes to go about 6 miles[51]. To create a more proficient transit system, the BRT will have to be quicker than this current bus route. This can be done by streamlining the route.



Map Provided by Greater Cleveland Transit Authority[52]

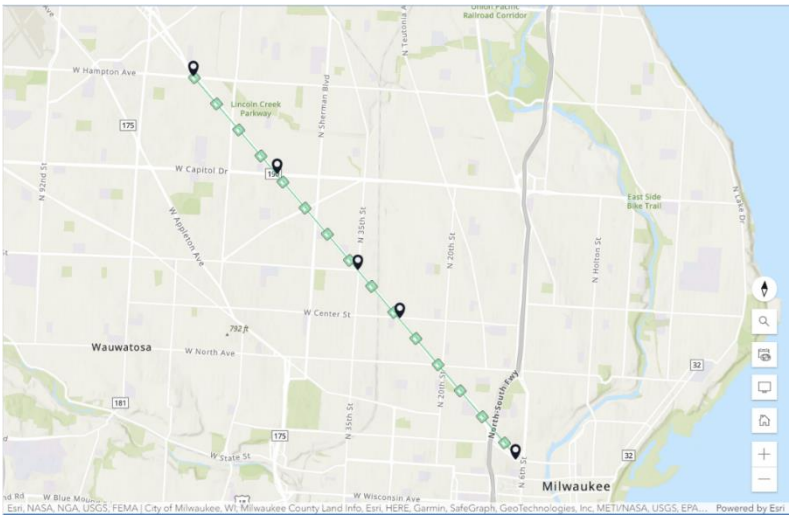
Here is Cleveland's Healthline running at 15 minutes or better frequency. The average travel time going on 11/29/23 westbound is:

[50] MCTS- Ride MCTS - BlueLine: Fond du Lac - National
[51] MCTS- Ride MCTS - BlueLine: Fond du Lac - National
[52] RTA- RTA - System Map (riderta.com)

1. Stokes – Windemere Rapid Station Time Difference between 7:21 am to 7:27 am: 6 minutes
2. Euclid and Lakeview time difference between 7:27 am to 7:36 am: 9 minutes
3. Euclid and E 105 time difference between 7:36 am to 7:48 am: 12 minutes
4. Euclid and Ontario time difference between 7:48 am to 8:02 am: 14 minutes

The total time taken to complete the route is 41 minutes, with an average of 10.25 minutes between stops in about 7 miles[53]. The evidence from HealthLine illustrates the potential for a more efficient and effective BRT system along West Fond du Lac Avenue, emphasizing the need for strategic planning, community engagement, and the integration of modern technologies to enhance the overall transit experience.

To illustrate the optimized bus line design, consider the following hypothetical map for the West Fond du Lac Avenue Corridor, showcasing strategically planned routes, major transit hubs, and key stops along the corridor.



To address the high number of crashes along the Fond du Lac Avenue corridor, key intersections have been identified, namely Fond du Lac Ave and W Hampton Ave, Fond du Lac Ave and Capital Drive, Fond du Lac Ave and Center Street, and Fond du Lac Ave and Burleigh. Residents would have the choice of either preceding northbound or southbound. The implementation of TOD along the BRT route at these intersections aims to alleviate safety concerns and enhance the overall street infrastructure. This targeted approach focuses on areas with a historically high incidence of crashes, promoting safety and efficiency.

TOD is proposed along the BRT route to specifically address safety concerns at these key intersections. By strategically planning development initiatives at these locations, the aim is to not only enhance the streetscape but also contribute to a reduction in accidents. TOD

[53] RTA- HealthLine - rideRTA.com

emphasizes mixed-use developments, creating a blend of residential, commercial, and recreational spaces. This comprehensive approach seeks to transform these intersections into vibrant, pedestrian-friendly zones, fostering safety and community engagement.

The BRT could begin at the intersection of Fond du Lac Ave and W Hampton Ave due to the availability of green space, offering an opportunity to construct an efficient and aesthetically pleasing transit station. This location also presents the possibility of transforming the intersection into a roundabout, given its divergence into two different directions—one leading to an affordable housing neighborhood and the other transitioning into a highway. The incorporation of a roundabout, coupled with a transit station in the center, maximizes the utility of the available space and enhances traffic flow. The selection of Amtrak Station as the destination holds strategic significance because it serves as a central nexus for various modes of transit, making it an ideal location to stimulate increased ridership. The envisioned bus terminal at Amtrak Station is thoughtfully designed with contemporary amenities such as covered waiting areas and digital information displays, elevating the overall transit experience for passengers. Another destination could be the Fizer Forum as it already has a commercial hub that could be economically prosperous for both it and the BRT. By strategically situating the terminus at Amtrak Station or Fizer Forum, the BRT project aspires to establish a seamlessly integrated and community-centric public transit system.

Appendix K: TOD Principles, Streetscape Design, and Transportation Demand Management (TDM)

The proposed alternative integrates Transit-Oriented Development principles, a streetscape design focused on green elements, and Transportation Demand Management strategies to create a vibrant, safe, and sustainable West Fond du Lac Avenue. Implementing TOD principles involves fostering mixed-use developments along the corridor. Zoning policies and incentives will play a crucial role in encouraging diverse developments, including residential, commercial, and recreational spaces.

1. **Key Zoning Policies:**

- *Mixed-Use Zoning:* Advocate for the adoption of mixed-use zoning policies, encouraging the coexistence of residential, commercial, and recreational spaces within the same development zones.
- *Density Bonuses:* Introduce density bonuses as incentives for developers incorporating a mix of land uses, rewarding higher-density developments aligned with affordable housing provisions.
- *Affordable Housing Requirements:* Implement requirements for developers to include affordable housing units, striving for a balanced mix of housing options.
- *Commercial and Recreational Space Incentives:* Provide incentives for the inclusion of commercial spaces and recreational amenities in mixed-use developments.

- *Flexible Land Use Planning:* Adopt flexible land use planning approaches, allowing for adaptive reuse of existing structures to facilitate the transformation of underutilized spaces.
- *Community Engagement and Stakeholder Involvement:* Establish programs for public participation, workshops, town hall meetings, and outreach initiatives to gather input on desired developments and amenities.

2. **Streetscape Design and Green Infrastructure:** This proposal seeks to create a more welcoming and vibrant corridor by addressing vehicular traffic and pedestrian safety challenges through the incorporation of green elements.

- *Foliage as a Traffic-Calming Measure:* Strategically place trees and bushes to visually narrow the street, encouraging drivers to reduce speeds and promoting a safer environment for pedestrians.
- *Green Streetscape Design:* Implement a green infrastructure strategy by integrating trees and greenery into medians and along sidewalks, creating a pleasant and inviting atmosphere for residents and visitors.
- *Plazas at Transit Hubs:* Establish plazas at transit hubs as focal points for community interaction, designed with seating, shading, and amenities to encourage people to gather and host events.
- *Rain Gardens and Permeable Surfaces:* Integrate rain gardens and permeable surfaces to manage stormwater runoff, contributing to the ecological health of the corridor.
- *Energy-Efficient Building Designs:* Encourage the incorporation of energy-efficient building designs in new developments to align with broader environmental goals.

3. **Transportation Demand Management Strategies:** A key initiative involves implementing strategies to promote alternative modes of transportation, reducing reliance on private vehicles.

- *Enhanced Pedestrian Infrastructure:* Improve pedestrian infrastructure, including sidewalks, crosswalks, and pedestrian-friendly crossings to create safer and more accessible pathways.
- *Cycling Infrastructure Development:* Encourage cycling through dedicated bike lanes, bike-sharing programs, and secure bike parking facilities. A strategic partner in this endeavor could be Bublr Bikes.
- *Public Transit Incentives:* Collaborate with the Milwaukee County Transit System to provide incentives for public transit use, including discounted fares, promotional events, and improved transit amenities.
- *Employer-Based Initiatives:* Engage with local employers to establish initiatives such as flexible work hours, telecommuting options, and employer-sponsored transit passes.
- *Educational Campaigns:* Launch awareness campaigns to champion alternative transportation modes, informing the community about the environmental and health benefits of reducing reliance on private vehicles.

- *Community Engagement and Feedback:* Implement a continuous feedback mechanism to assess the effectiveness of TDM strategies, soliciting input from residents, businesses, and commuters for ongoing improvement.

This comprehensive approach aims to transform West Fond du Lac Avenue into a well-integrated, sustainable, and community-centric urban environment. By combining TOD principles, green streetscape design, and TDM strategies, the alternative seeks to promote equity, environmental sustainability, and economic prosperity along the corridor.

Appendix L: BRT Costs Breakdown

Categories	Values
Construction Costs for RTA (Adjusted 1 year)	$266,015,289
Construction Costs for FDL (Adjusted 1 year)	*$190,010,921*
Construction Costs for BRT	$41,000,000
Total RTA Operation Costs (Adjusted 1 year)	$336,080,000
FDL Estimated Operation Cost	*$240,057,143*
Operation Cost For Health Line (2012)	$8,200,000
Operation Cost For Health Line (adjusted 1 Year)	$11,390,557
Assumption of 3:1 Benefit	$157,171,671
Benefit Per Year Annually Over 20 Years	$15,717,167
Daily Customers (BlueLine)	1,170
Estimated New Ridership	1,404
Daily Savings Per Person	$0.38
Daily Value of Time Saved	$6,402
(Annual)	*$2,336,818*
Time Savings Per Day	16848
Economic Benefits Annually RTA	$950,000,000
Time Savings for 1 year	$2,336,818
Additional Benefit Per Mile (annual)	$467,364
Total Deaths between 2008 to 2018	9
Estimated Deaths Prevented	3.96
Value of Statistical Life Per Person	$12,474,000
Total Economic Benefits- Fatalities Prevented	$49,397,040
(Annual)	*$4,939,704*

Break Down

- Construction Costs: The proposed Bus Rapid Transit (BRT) system on Fond du Lac Ave is estimated to incur a one-time construction cost of $41 million[54]. This figure encompasses the expenses associated with establishing the necessary infrastructure for the BRT.
- Operation Costs: The operation costs for the Healthline in 2012 were $8,200,000[55], so adjusted for inflation in 2023 would be $11,390,557. This analysis will operate under this assumption.
- Benefits: The American Public Transportation Association (APTA) states that transit investment has a 5:1 investment benefit[56]. To be conservative, we will assume a 3:1 benefit ratio, the total benefit, including both construction and operation. This leads to an estimated annual profit of $107.78 million.
- New Ridership: Currently, the Blueline has 1,170 daily customers. With the implementation of the BRT, we assume a conservative 20% ridership increase, which would bring us up to an estimated 1,404 new ridership. When Healthline was implemented, Cleveland saw a 50% increase in ridership, we did not anticipate the same amount of ridership so we concluded that 20% would be a more realistic number.
- Monetary Value of Time: To quantify the time saved by commuters, we calculate the monetary value of time. This involves considering the average annual salary in the area, which is $47,491[57],and the average annual hours of work, which is 2080 hours. With a time saved per commute of 12 minutes (between the Blueline's 53 minutes and Healthline's 41 minutes), we determine the hourly rate as $47,491 divided by 2080, resulting in approximately $22.83 per hour. The monetary value of time is then calculated by multiplying the hourly rate by the proportion of time saved (12 minutes out of 60). This yields a value of $4.57 per commuter for every commute. Dividing $4.57 by the number of minutes being 12, this comes to $0.38 daily saved per person. With an estimated 1,404 new daily riders, the total daily time savings is 16,848 minutes. The Cleveland Healthline improved its transit from 46 minutes to 34 minutes[58], (25%). Blueline's current corridor time is 53 minutes; a new BRT time could improve transit time to 40 minutes based on the improvements of the Healthline. The total monetary value of time savings for 1,404 daily customers (totaling 16,848 total minutes) at $0.38

[54] National Academies Press- Chapter 9 - Financing and Implementing BRT Systems | Bus Rapid Transit, Volume 2: Implementation Guidelines | The National Academies Press
[55] US Department of Transportation Federal Transit Administration- Euclid Corridor Transportation Project; Cleveland, OH 2012 (dot.gov)
[56] American Public Transportation Association- Economic Impact Of Public Transportation Investment - American Public Transportation Association (apta.com)
[57] Point 2- Near North Side Milwaukee, WI Household Income, Population & Demographics - Point2 (point2homes.com)
[58] RTA- RTA's HealthLine -- the world-class standard for BRT service | rideRTA.com

per person is $2,667.60. Annually, this equals to $973,674. Understanding the monetary value of time is crucial as it goes beyond mere minutes saved. It assigns a tangible economic value to the time efficiency introduced by the BRT. This value represents not only the commuters' time but also the potential economic productivity gained through reduced travel time.

- Safety Impact: Between the years of 2008 to 2018, there have been 9 deaths on Fond du Lac Ave[59]. Implementation of BRTs traditionally prevents 50% of fatal accidents[60]. Taking this into consideration we can assume that 50 percent of deaths would have been prevented if implemented earlier, which adds up to 3.96 deaths over the decade. If we consider this annually, it is about 1 person per year. The value of statistical life per person is $12,474,000[61]. If one death were prevented annually, the BRT would have saved $4,939,704.

Appendix M: Net Present Value – Bus Rapid Transit (BRT)

Net Present Value- Bus Rapid Transit (BRT)

$

		Annual Benefits				Annual Costs
Year	Period	Public Transport. Ben.	Time Saved Ben.	Fatalities Prevented	Total Benefits	Construction
2023	0				$0.00	$41,000,000.00
2024	1	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2025	2	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2026	3	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2027	4	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2028	5	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2029	6	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2030	7	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2031	8	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2032	9	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2033	10	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2034	11	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2035	12	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2036	13	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2037	14	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2038	15	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2039	16	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2040	17	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2041	18	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2042	19	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	
2043	20	$6,150,000.00	$970,000.00	$5,000,000.00	$12,120,000.00	

[59] Wisconsin Department of Transportation- Community Maps - Crash

[60] National Library of Medicine- Road Safety Effects of Bus Rapid Transit (BRT) Systems: a Call for Evidence - PMC (nih.gov)

[61] NSC Injury Facts- Costs of Motor-Vehicle Crashes - Injury Facts (nsc.org)

Annual Costs			Discount rate	0.0700	
Construction	Marginal Oper. Cost	Total Costs	(Benefits - Costs)	Denominator	(Benefits - Costs)/Denominator
$41,000,000.00		$41,000,000.00	-$41,000,000.00	1.00	-$41,000,000.00
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.07	$5,345,794.39
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.14	$4,996,069.53
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.23	$4,669,223.86
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.31	$4,363,760.61
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.40	$4,078,280.95
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.50	$3,811,477.52
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.61	$3,562,128.52
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.72	$3,329,092.08
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.84	$3,111,301.01
	$6,400,000.00	$6,400,000.00	$5,720,000.00	1.97	$2,907,757.95
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.10	$2,717,530.80
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.25	$2,539,748.41
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.41	$2,373,596.64
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.58	$2,218,314.62
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.76	$2,073,191.23
	$6,400,000.00	$6,400,000.00	$5,720,000.00	2.95	$1,937,561.90
	$6,400,000.00	$6,400,000.00	$5,720,000.00	3.16	$1,810,805.51
	$6,400,000.00	$6,400,000.00	$5,720,000.00	3.38	$1,692,341.60
	$6,400,000.00	$6,400,000.00	$5,720,000.00	3.62	$1,581,627.66
	$6,400,000.00	$6,400,000.00	$5,720,000.00	3.87	$1,478,156.70
				NPV =	$19,597,761.48

Notes:
1. Operating costs are estimated at $11.4 million per year, which represents an additional $6.4 million over current operating costs.
APTA's estimate of 5:1 in order to remain conservative in our estimates. Economic Impact Of Public Transportation Investment – American Public Transportation Association (apta.com)
3. Calculation notes for time saved, fatalities prevented, construction costs and marginal operating costs are available in APPENDIX G
4. A social discount rate of 7% is used Source: USDOT p.10 https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf
Suggestion: Based on the positive NPV, the alternative can be considered for construction.

- Summary: The Net Present Value (NPV) analysis for the Bus Rapid Transit (BRT) alternative reveals a favorable economic outlook. Over the 20-year period, the benefits, comprising public transportation benefits, time-saved benefits, and fatalities prevented, consistently outweigh the costs. The NPV, calculated at a 7% discount rate, stands at $19,597,761.48, indicating a positive return on investment. Operating costs, estimated at $11.4 million per year, are factored into the calculations. The public transportation benefits are based on a conservative 3:1 ratio of construction costs to economic benefits, ensuring a cautious estimate. The positive NPV suggests that the BRT alternative is financially viable, supporting its consideration for construction. Further details are explained below.
- Timeframe: The timeframe over 20 years was determined by taking into consideration when the benefits would occur over time and giving a realistic outlook into implementation.
- Annual Benefits:
  - Public transportation benefits are the economic benefits associated with the public transportation improvements introduced by the BRT system. They include factors such as increased ridership, reduced travel time, and overall enhancement of the public transit system. Public transportation benefits are based on a 3:1 ratio of construction

costs to economic benefits[62]. This amount is lower than APTA's estimate of 5:1 to remain conservative in our estimates. The number of 6.15 million was reached by taking the one-time cost of 41 million multiplied by 3 (3:1 ratio) and then dividing by 20 over the twenty years.

- Time-saved benefits represent the value associated with time savings for commuters resulting from the improved efficiency of the public transportation system. The time saved is translated into monetary value, considering factors such as average wages and the time saved per commute. This was already determined and rounded to $970,000. See the Monetary Value of Time calculations above in costs.
- Fatalities prevented involves the economic value associated with preventing fatalities or accidents due to the implementation of the BRT system. The costs related to accidents, such as medical expenses and loss of productivity, are factored into the benefits. The monetary value of this was already determined above in the costs section and rounded to 5 million. Please take a look at the Safety Impact above in terms of costs.
- All of these benefits added up equals to 12.12 million per year over 20 years.

• Annual Costs:

- Construction costs represent the one-time expenditure associated with building and implementing the BRT system. In the case of the one-time construction, costs were determined to be 41 million as stated in the cost section above.
- Marginal Operating Costs are the additional operating expenses incurred annually as a result of the BRT system. This includes expenses beyond the existing operating costs, such as maintenance, fuel, and labor for the enhanced public transportation services. Operating costs are estimated at $11.4 million per year as determined above in the costs section. If the current Green Line costs $5 million to operate[63], the additional $6.4 million would be included to operate the BRT.
- Total Costs are the sum of the construction costs and marginal operating costs for each year. It reflects the ongoing financial commitment required to maintain and operate the BRT system.
- The provided data indicates a consistent annual total cost of $5,720,000, starting from the initial year (2023) and continuing throughout the analyzed period.

• Benefits – Costs: This is the arithmetic subtraction of the total annual costs from the total annual benefits, resulting in a net value. A positive value indicates that the benefits outweigh the costs.

• Discount Rate: The discount rate is a crucial factor in calculating the Net Present Value (NPV) of future cash flows. A discount rate of 7% is used to discount future benefits and costs back to their present value. The discount rate reflects the time value for money and the opportunity cost of investing funds elsewhere.

• Denominator: This expression in the denominator represents the discount factor applied to each year's benefits and costs. It ensures that future values are discounted back to their present value, considering the discount rate.

[62] American Public Transportation Association- Economic Impact Of Public Transportation Investment - American Public Transportation Association (apta.com)

[63] MCTS Communication- UWM PPA Presentation (2023)

- (Benefits - Costs) / Denominator: This expression represents the calculation of the Net Present Value (NPV) for each year. It involves dividing the net benefits (benefits minus costs) by the discount factor. The result provides the present value of the net benefits for each year.
- Cumulative NPV: The cumulative NPV is derived by summing up the annual NPVs. A positive cumulative NPV indicates that the overall benefits over the years outweigh the overall costs, reinforcing the financial feasibility of the BRT alternative. Based on the positive NPV of $19.5 Million, the alternative can be considered for construction.

Appendix N: Net Present Value Bus Rapid Transit (BRT) Light and Protected Bike Lane

Net Present Value- Bus Rapid Transit (BRT) Light

		Annual Benefits					Annual Costs
Year	Period	Public Transport. Ben.	Time Saved Ben.	Bike Inj. Prevented	Bike Lane Econ. Ben.	Total Benefits	Construction
2023	0					$0	$25,000,000.00
2024	1	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2025	2	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2026	3	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2027	4	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2028	5	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2029	6	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2030	7	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2031	8	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2032	9	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2033	10	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2034	11	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2035	12	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2036	13	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2037	14	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2038	15	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2039	16	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2040	17	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2041	18	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2042	19	$840,000	$340,000	$930,000	$25,000	$2,135,000	
2043	20	$840,000	$340,000	$930,000	$25,000	$2,135,000	

	Discount rate	0.0700	
Total Costs	(Benefits - Costs)	Denominator	(Benefits - Costs)/Denominator
$25,000,000.00	-$25,000,000.00	1.00	-$25,000,000.00
$0.00	$2,135,000.00	1.07	$1,995,327.10
$0.00	$2,135,000.00	1.14	$1,864,791.68
$0.00	$2,135,000.00	1.23	$1,742,795.97
$0.00	$2,135,000.00	1.31	$1,628,781.28
$0.00	$2,135,000.00	1.40	$1,522,225.49
$0.00	$2,135,000.00	1.50	$1,422,640.65
$0.00	$2,135,000.00	1.61	$1,329,570.70
$0.00	$2,135,000.00	1.72	$1,242,589.44
$0.00	$2,135,000.00	1.84	$1,161,298.54
$0.00	$2,135,000.00	1.97	$1,085,325.74
$0.00	$2,135,000.00	2.10	$1,014,323.12
$0.00	$2,135,000.00	2.25	$947,965.53
$0.00	$2,135,000.00	2.41	$885,949.10
$0.00	$2,135,000.00	2.58	$827,989.81
$0.00	$2,135,000.00	2.76	$773,822.25
$0.00	$2,135,000.00	2.95	$723,198.37
$0.00	$2,135,000.00	3.16	$675,886.32
$0.00	$2,135,000.00	3.38	$631,669.46
$0.00	$2,135,000.00	3.62	$590,345.29
$0.00	$2,135,000.00	3.87	$551,724.57
		NPV =	-$2,381,779.59

Notes:
1. Alternative does not propose further adjustments to bus frequency or operations, thus we do incurr additional operating expens
2. Public transportation benefits are based on a 1:1 ratio of construction costs to economic benefits. This amount is lower than APTA's estimate of 5:1, as the alternative enhances an existing service, serves a less robust economic area and maintains conservative estimates in benefit amounts
3. Calculation notes for time saved, bike injuries prevent, lane economic benefits and construction costs are available in APPENDIX
4. A social discount rate of 7% is used Source: USDOT p.10 https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf
5. Economic benefit: station construction costs ($16.8 Million)/20 years
Suggestion: Based on the negative NPV, the alternative should not be considered for construction.

Appendix O: Bus Net Present Value - Bus Rapid Transit (BRT) Light and Protected Bike Lane Cost Estimates

Categories	Values
Construction Costs	$21,704,816
Operation Costs (annually)	$5,000,000
TOTAL ESTIMATED COSTS (Year 1)	*$26,704,816*
Estimated Value- Time Savings (annually)	$186,885
Estimated Value- Injury Prevention (annually)	$937,800
Estimated Economic Benefit- Protected Bike Lane (annually)	$25,000

COST ESTIMATES

2014 Estimated Station Construction Costs

Station Items	2014 Cost Estimate		
Shelter	$35,000	*Source: Pace Report p.128*	acebus.com/sites/default/files/2020-07/TR_PMO_MilwaukeeARTProjectDefinition_2014-12-31.pdf
Vertical Marker	$60,000		
Real-time sign (x2)	$12,000		
Bench	$1,650		
Trash Receptacle	$1,600		
Bike rack	$1,300		
Infrared Heaters (x2)	$12,000		
Pavement Snowmelt	$12,000		
Railing	$9,600	*Note: $120 per square foot, estimated 10x80 foot stations*	*Note: MCTS prefers at least 80ft long stops*
TOTAL	$145,150		
2014-2023 CPI estimated increase	*30%*	*Source: U.S. Bureau of Labor Statistics (actual: 27.9%)*	https://www.bls.gov/data/inflation_calculator.htm

2023 Estimated Station Construction Costs

Station Items	2023 Inflation-Adjusted Estimates		
Shelter	$45,500		
Vertical Marker	$78,000		
Real-time sign (x2)	$15,600		
Bench	$2,145		
Trash Receptacle	$2,080		
Bike rack	$1,690		
Infrared Heaters (x2)	$15,600		
Pavement Snowmelt	$15,600		
Railing	$12,480		
TOTAL (per station) (55%)	$188,695	*Source: Pace report p.132*	acebus.com/sites/default/files/2020-07/TR_PMO_MilwaukeeARTProjectDefinition_2014-12-31.pdf
Other construction costs	$84,913	*Additional cost factors (45%) include: Demolition, Contractor, Contingency and "lump-sum" (other utilities and miscellaneous) costs*	
Grand Total	$273,608		

MCTS Station Cost Estimate

1 station	$1,000,000	Source: MCTS Communication	*Rationale: Given MCTS's more recent estimate, we will proceed with their estimated station cost*
Current MCTS Blue Line station count (Walnut to Hamption)	42	*Source: MCTS*	https://www.ridemcts.com/real-time/bus-map?BLU-%23214080
Projected MCTS Blue Line station count (Walnut to Hampton)	24	*Rationale: We will reduce the number of stops by spacing stations ~0.5 miles apart. 2 additional stations in each direction will be accommodated for high traffic areas and other route connections etc.*	
Total Station Construction Cost Estimate	$16,800,000	*Note: 30% of corridor length is between North Ave and Burleigh St, where in-lane stops will not be utilized. This corridor is subtracted from cost estimate*	

Bike Lane Construction Costs

Items	Cost	Per___	Amount Needed	Cost (2010 dollars)	Source
Separated One-way Cycle Tracks	$300,000	mile	10	$3,000,000	*2010 City of Milwaukee*
"Flex Zone" Markings	$25,000	mile	10	$250,000	
Green Paint	$1.60	square foot	158,400	$253,440	

	2023 Inflation-Adjusted Estimates	
Separated One-way Cycle Tracks	**$4,200,000**	*Source: U.S. Bureau of Labor Statistics (actual:37.8%)*
"Flex Zone" Markings	**$350,000**	
Green Paint (Wide Section)	**$354,816**	

Final Cost Estimates

Bus Station and Bike Lane Estimated Sub-Total:	$21,704,816		
Operation Expenses			
1-year Blue Line Operation	*$5,000,000*	*Source: MCTS communication*	*Note: MCTS estimates Green Line operations at $5 million per year, which we will estimate as an approximate value for Blue Line operations*
ESTIMATED TOTAL COSTS (year 1)	$26,704,816.00		

BENEFIT PROJECTIONS

Ridership Growth Projection

Current Daily MCTS Blue Line Ridership (corridor)	1170	Source: MCTS Communication	
Pace projected ridership increase	33%	*Source: Pace report p.139*	bus.com/sites/default/files/2020-07/TR_PMO_MilwaukeeARTProjectDefinition_2014-12-31.pdf
Our estimated increase	*15%*	*Rationale: Pace's projection was a pre-COVID projection; transit ridership nationally has gone down post-pandemic. Additionally, Pace's plan called for maintaining the existing route at reduced levels in addition to a new BRT route along the corridor. Our alternative will only propose upgrading the current Blue Line*	
Projected New MCTS Blue Line Ridership (corridor)	1346		
Net New Riders	*176*		

Time Savings Projection

Descriptions

Signal Priority and Stop Spacing	5%	*Source: Pace report p.104*	
In-lane stops	10 seconds per stoppage	*Note: An estimated 9 in-lane stations will be built in each direction (75% of 12-station corridor).*	

Calculations

Item	Seconds	
Signal Priority and Stop Spacing	60	
In-lane stops	60	*Note: We will assume two-thirds (six total) of stations will result in a bus stoppage*
Time Saving Estimate (seconds)	*120*	
% Improvement	10.00%	
Average Annual Corridor Wage	$47,491	
(full time per hour)	*$23*	
Total Daily Time Savings (minutes)	2,691	
Wage value per minute saved	$0.38	
Adjusted Total Daily Time Savings (minutes)	2,692	
VALUE OF TOTAL TIME SAVED (Daily)	$512	
(Annually)	*$186,885*	

Bicyclist Injury Reductions			
Expected Bicycle Crash Reduction	30%	*Source: NACTO PDF*	wp-content/uploads/2010/08/Risk-of-injury-for-bicycling-on-cycle-tracks-versus-in-the-street.pdf
		Note: Study result was 28%. Given Fond Du Lac's inclusion on the pedestrian high injury network, as well as generally unsafe current conditions, a slightly higher percentage gain can be achievable.	
2018-2022 Corridor Bicycle Crash Counts (by type)			
Fatal Injury	1		
Serious Injury	2		
Suspected Minor Injury	4		
Possible Injury	2		
5-year Projected Corridor Bicycle Crashes Prevented (by type)		CDC Cost of Injury (by type)	
Fatal Injury	0.3	$12,474,000	
Serious Injury	0.6	$1,016,000	
Suspected Minor Injury	1.2	$221,000	
Possible Injury	0.6	$120,000	
Projected Corridor Cost Savings (by type)			
Fatal Injury	$3,742,200		
Serious Injury	$609,600	*Source: National Safety Council*	https://injuryfacts.nsc.org/all-injuries/costs/guide-to-calculating-costs/data-details/
Suspected Minor Injury	$265,200		
Possible Injury	$72,000	*Rationale: Projecting whole number reductions in small sample sizes is difficult to predict accurately. Partial projections can be used to assess levels of estimated benefits, but realized benefits may vary significantly.*	
TOTAL (5 years)	$4,689,000		
Total (Annually)	*$937,800*		
Economic Development Projection- Transit			
Estimated Activity- APTA Estimate	$5 in economic activity for every $1 invested in transit	*Source: APTA 2022 Factbook*	www.apta.com/wp-content/uploads/APTA-2022-Public-Transportation-Fact-Book.pdf
Our estimated economic activity level	$1 in economic activity for every $1 invested in transit	*Rationale: Upgrading a current route won't result in the same level of additional activity as a new route. While we do believe better transit services can foster economic development, we must also be conservative with our estimates. Estimated benefit is over a 20-year period.*	
Estimated Economic Benefit	*$16,800,000*		
Economic Development Projection- Biking			
Bike Lane Benefit to Retail Sales	$25,000	*Source: Urban Institute*	r-more-connected-cycling-infrastructure#:~:text=In%202013%2C%20for%20example%2C%20salt,a%207.0%20percent%20increase%20citywide.
		Rationale: Bike lanes have been shown to produce increased retail sales in multiple studies, including this Urban Institute study. However, quantifying this number for a currently struggling corridor is difficult. We will assume some level of benefit, but remain extremely conservative in this estimate.	
		Other Notes: Estimate is intended to represent all potential economic benefits associated with installation of protected bike lanes from Hampton Street to Walnut Avenue	

Appendix P: Tactical Improvements

Categories	Values	
Construction Costs (Adjusted 1 year)		$1,390,089.00
Daily Customers (Blue Line)[64]		1,170
Estimated New Ridership[65]		59
Daily Savings Per Person		$0.38
Daily Value of Time Saved*		$934
(Annual) Timed Saved	$	340,785.90
Time Savings Per Day		$1,053
Economic Benefits Annually**		$1,390,089
Time Savings for 1 year		$340,786
Additional Benefit Per Mile (annual)		$68,157
Total Deaths between 2008 to 2018		9
Estimated Deaths (annual)		0.9
Estimated Deaths Prevented (annual)		6.3
Value of Statistical Life Per Person[66]		$12,474,000
Total Saved for each Death Prevented		$78,586,200
(Annual)		$7,858,620
Total Benefits		$79,635,503
Total Costs		**$1,390,089**
Net Benefit		$78,245,414
Cost Benefit Ratio		**57.29**

*Estimated time saved in 2 minutes. Time saved multiplied by the value of time saved which is then multiplied by the number of estimated riders.
**Economic Benefits annually is estimated by a conservative 1:1 ratio, assuming for every dollar spent on transportation infrastructure returns $1 of economic benefit. Source: American Public Transit Association

[64] MCTS Communication- UWM PPA Presentation (2023)
[65] Victoria Transport Policy Institute- When Are Bus Lanes Warranted? - Considering Economic Efficiency, Social Equity and Strategic Planning Goals (pp. 1–23)
[66] National Safety Council- Costs of motor-vehicle crashes

Appendix Q: Tactical Improvements Itemized Costs

Modifications	Unit Quantity	Cost/Unit	Cost	Source	Infation	
		Walnut - North				
Modifications	**Unit Quantity**	**Cost/Unit**	**Cost**	**Source**	**Infation**	
Remove bump out	2	$ 5,000.0	$ 10,000	Walkinginfo.org	32.07%	$ 13,207.00
Curb (mi)	0.03	$ 79,000.0	$ 2,370	Walkinginfo.org	32.07%	$ 3,130.06
New Curb	2	$ 1,500.0	$ 3,000	City of Milwaukee	20.34%	$ 3,610.20
Bus shelter	2	$ 7,500.0	$ 15,000	City of Alexandria (20	48.39%	$ 22,258.50
Bus Lane Paint (ft^2)	4720 = (3960ft* 12ft lane)	$ 1.6	$ 7,552	City of Milwaukee	20.34%	$ 9,088.08
Construct Sidewalk	0.7	$ 290,000.0	$ 20,300	Walkinginfo.org	32.07%	$ 26,810.21
Audible Pededstrian Signal	10	$ 5,000.0	$ 50,000	City of Milwaukee	20.34%	$ 60,170.00
High Visibility Crosswalk	5	$ 1,500.0	$ 7,500	City of Milwaukee	20.34%	$ 9,025.50
Street Beautifcation Corners*	10	$ 5,000.0	$ 50,000	City of Milwaukee	20.34%	$ 60,170.00
		North to Center				
Modifications	**Unit Quantity**	**Cost/Unit**	**Cost**	**Source**	**Infation**	
Bus Lane Paint (ft^2)	4352 = (3696*12ft lane)	$ 1.6	$ 6,963	City of Milwaukee	20.34%	$ 8,379.51
Bus shelter	2	$ 7,500.0	$ 15,000	City of Alexandria (20	48.39%	$ 22,258.50
Curb Extension	2	$ 5,000.0	$ 10,000	Walkinginfo.org	32.07%	$ 13,207.00
Audible Pededstrian Signal	16	$ 5,000.0	$ 80,000	City of Milwaukee	20.34%	$ 96,272.00
High Visibility Crosswalk	8	$ 1,500.0	$ 12,000	City of Milwaukee	20.34%	$ 14,440.80
Street Beutifcation Corners*	16	$ 5,000.0	$ 80,000	City of Milwaukee	20.34%	$ 96,272.00
		Center to Burleigh				
Modifications	**Unit Quantity**	**Cost/Unit**	**Cost**	**Source**	**Infation**	
Bus Lane Paint (ft^2)	44173 = (3681*12ft lane)	$ 1.6	$ 70,677	City of Milwaukee	20.34%	$ 85,052.46
Bus shelter	2	$ 7,500.0	$ 15,000	City of Alexandria (20	48.39%	$ 22,258.50
Curb (mi)	0.02	$ 79,000.0	$ 1,580	Walkinginfo.org	32.07%	$ 2,086.71
Curb extension	1	$ 5,000.0	$ 5,000	Walkinginfo.org	32.07%	$ 6,603.50
Audible Pedestrian Signla	12	$ 5,000.0	$ 60,000	City of Milwaukee	20.34%	$ 72,204.00
High Visibility Crosswalk	6	$ 5,000.0	$ 30,000	City of Milwaukee	20.34%	$ 36,102.00
Street Beutifcation Corners*	12	$ 5,000.0	$ 60,000	City of Milwaukee	20.34%	$ 72,204.00
		Burleigh to Captiol			**Infation**	
Remove Bump out	7	$ 5,000.0	$ 35,000	Walkinginfo.org	32.07%	$ 46,224.50
Bus Lane Paint	49,753=(4,146* 12ft lane)	$ 1.6	$ 79,605	City of Milwaukee	20.34%	$ 95,796.66
				Sub Total		$ 896,831.68
				Design	20.00%	$ 179,366.34
				Contingency	15.00%	$ 134,524.75
				Staff Costs	20.00%	$ 179,366.34
				Total		$ 1,390,089.11

*Street beautification is estimated from the cost of one bench for each corner of an intersection.

Appendix R: Net Present Value – Tactical Improvements

Net Present Value- Ta

		Annual Benefits			
Year	Period	Public Transport. Ben.	Time Saved Ben.	Injuries Prevented	Total Benefits
2023	0	$140,000.00	$340,000.00	$7,860,000.00	$480,000.00
2024	1	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2025	2	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2026	3	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2027	4	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2028	5	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2029	6	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2030	7	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2031	8	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2032	9	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2033	10	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2034	11	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2035	12	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2036	13	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2037	14	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2038	15	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2039	16	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2040	17	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2041	18	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2042	19	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00
2043	20	$140,000.00	$340,000.00	$7,860,000.00	$8,340,000.00

actical Improvements

Annual Costs			Discount rate	0.0700	
Construction	Total Costs		(Benefits - Costs)	Denominator	(Benefits - Costs)/Denominator
$1,400,000.00	$1,400,000.00		-$920,000.00	1.00	-$920,000.00
	$0.00		$8,340,000.00	1.07	$7,794,392.52
	$0.00		$8,340,000.00	1.14	$7,284,478.99
	$0.00		$8,340,000.00	1.23	$6,807,924.29
	$0.00		$8,340,000.00	1.31	$6,362,546.07
	$0.00		$8,340,000.00	1.40	$5,946,304.74
	$0.00		$8,340,000.00	1.50	$5,557,294.15
	$0.00		$8,340,000.00	1.61	$5,193,732.85
	$0.00		$8,340,000.00	1.72	$4,853,955.93
	$0.00		$8,340,000.00	1.84	$4,536,407.41
	$0.00		$8,340,000.00	1.97	$4,239,633.10
	$0.00		$8,340,000.00	2.10	$3,962,273.92
	$0.00		$8,340,000.00	2.25	$3,703,059.74
	$0.00		$8,340,000.00	2.41	$3,460,803.50
	$0.00		$8,340,000.00	2.58	$3,234,395.79
	$0.00		$8,340,000.00	2.76	$3,022,799.80
	$0.00		$8,340,000.00	2.95	$2,825,046.55
	$0.00		$8,340,000.00	3.16	$2,640,230.42
	$0.00		$8,340,000.00	3.38	$2,467,505.06
	$0.00		$8,340,000.00	3.62	$2,306,079.50
	$0.00		$8,340,000.00	3.87	$2,155,214.48
				NPV =	$87,434,078.81

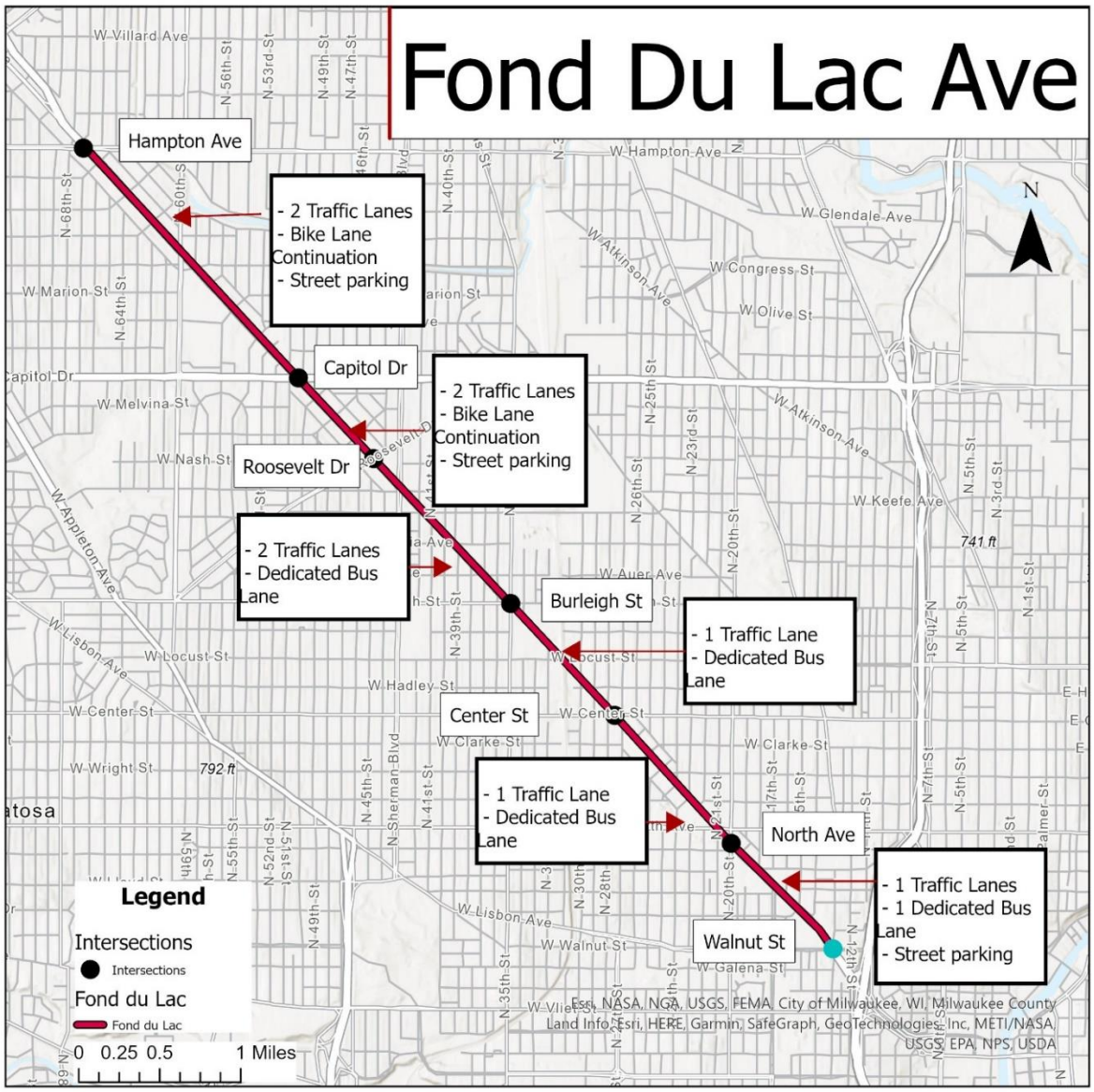
20Cost%20Analysis%20Guidance%202022%20%28Revised%29.pdf

Notes:

1. Alternative does not propose further adjustments to bus frequency or operations, thus we do incurr additional operating expenses
2. Economic benefits are based on a 2:1 ratio of construction costs to economic benefits. This amount is lower than APTA's estimate of 5:1, as the alternative enhances improvements to the streetscape rather than new transportation services
3. Calculation notes for time saved, injuries prevent and construction costs are available in APPENDIX X
4. A social discount rate of 7% is used — Source: USDOT p.10 — https://www.transportation.gov/sites/dot.gov/files/2022-03/Benefit%20Cost%20Analysis%20

Suggestion: Based on the positive NPV, the alternative can be considered for construction.

Appendix S: Fond du Lac Avenue Map



Appendix T: Fond Du Lac Avenue Map